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ABSTRACT

This guide for the development of a secondary school physical fitness and heart disease intervention program promotes the concept of good health through a crossdisciplinary approach to preventive medicine. The fundamental functions of the heart and factors that affect its efficiency are discussed, and exercises for improving cardiovascular functioning are presented, as well as outlines of sample aerobic conditioning programs. (JD)

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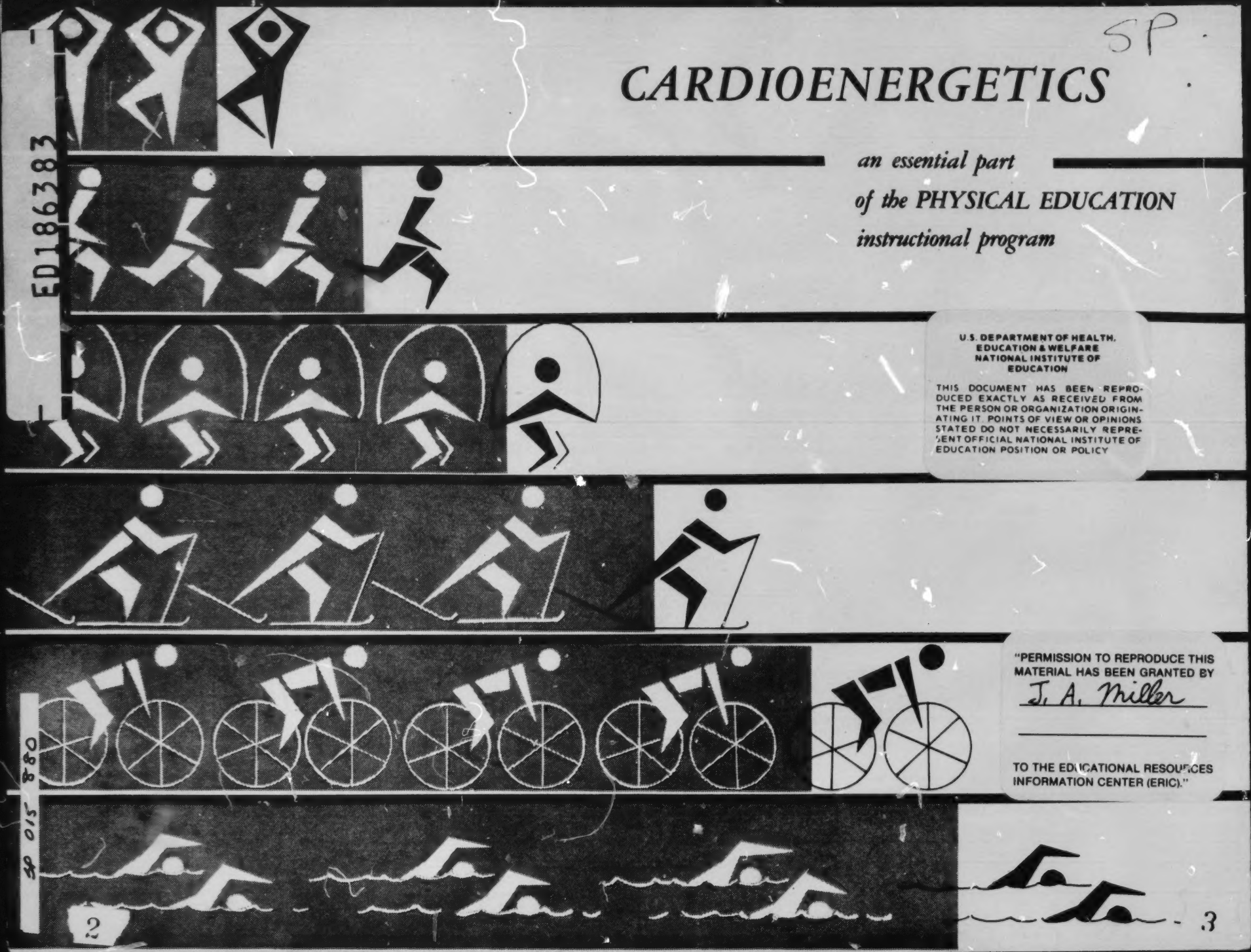
CARDIOENERGETICS

an essential part
of the PHYSICAL EDUCATION
instructional program



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What kind of education, in personal particular, should I wish my children to receive? First of all, and within the limits of nature and circumstance, I should want them to acquire some control over the conditions of their lives. Since the primary condition of life, and the strongest root of happiness, is health, I should like to see them abundantly instructed in the knowledge and care of their bodies... I should make education in health a required course in every year of schooling from kindergarten to Ph.D. I should want my children to learn as much about the structure and functioning, the care and healing, of their bodies as can be taught in an hour a day for fifteen scholastic years. I would have our physicians practice preventive medicine in the classroom by examination and instruction, in the hope that this might reduce the fashionable scissoring of the body in hospitals... And if the day should come when our dieticians will have at last made up their minds as to what they really know and believe, I should ask them to teach the principles of diet an hour in every school week for fifteen years, so that our people might make with some corporate intelligence the dietetic changes required by the passage from an outdoor and physical life to a mental and sedentary one. I would teach health and cleanliness first of all, and expect that all things else would be added unto them.

— Will Durant

Cover design by Lesa Clark

CARDIOENERGETICS

an essential part
of the
PHYSICAL EDUCATION instructional program

The University of the State of New York
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ART CREDITS

	PAGE NO(S).
American Heart Association	
"Your Heart and How It Works" (heart diagram)	2
Phonocardiogram	66
Researcher at Work	80
"The Problem of Cardiovascular Disease"	105
Lesa Clark, Illustrator	
Cover design	
Exercise figures	31-33 and 38-41
Medtronic, Inc.	
Heart diagram with natural pacemaker	64
Carotid and radial pulse sketches	68
National Council of the Young Men's Christian Associations of the United States of America	
"Time Allotments for Different Parts of Workout During Beginner's Program" (chart)	30
New York State Education Department Physical Fitness/Heart Disease Intervention Program Office	
Electrocardiograms	3, 37 and 62
"Point of Maximal Impulse" diagram	5
Xerox Education Publications	
"A Transportation Worker Speaks" (comic strip)	4

Foreword

Cardioenergetics is a guide for the development of secondary school physical fitness/heart disease intervention programs. It promotes the concept of "wellness" through a crossdisciplinary approach to "preventive medicine."

Since research has indicated that many of the chronic ills (cardiovascular disease, obesity, substance abuse, etc.) to which Americans fall prey at increasingly earlier ages are directly attributable to undetected/untreated conditions in childhood and/or the failure to develop lifestyles which are suitable for bodies built for action, the material in this publication is intended to help teachers to help students to understand the nature and importance of their own cardiovascular systems — and the factors that affect those systems — well enough to develop lifestyles that will foster their own well-being. Toward this end, the following pages suggest a laboratory approach to fitness education which includes comprehensive medical/physical fitness assessments; individually prescribed regimens of vigorous physical/recreational activity, with a large dollop of *fun;* and cognitive learning experiences in a variety of modes to answer the question, *Why?*. Specifically, it is hoped that the suggestions in this publication will:

- Provide students with a *working knowledge* of the cardiovascular system, the things that affect it, and the nature of those effects;
- Stimulate the *development of lifestyles* that include balanced nutrition, regular aerobic activity, and appropriate amounts of sleep; and
- Strengthen their basic learnings *in other parts of the school curriculum.*

Most of the program can be presented in standard physical education facilities (gymnasium, pool, athletic field,...); but since it incorporates a crossdisciplinary approach, teachers of English, health, home economics, mathematics, reading, science, and visual arts education are encouraged to provide learning experiences in their own areas of expertise which will reinforce the students' personal fitness programs while developing in them the necessary skills, knowledges, and attitudes for successful achievement in the respective disciplines.

The manuscript for *Cardioenergetics* was written by a team of specialists consisting of Nicholas G. Alexiou, M. D., medical director for children's medical services in the State of Florida's Department of Health and Rehabilitation Service; Larry A. Bjurstrom, exercise physiologist and coordinator of the New York State Education Department's Physical Fitness/Heart Disease Intervention Program; Ted T. Grenda, marathon runner and director of NYSED's Division of General Education; Elaine P. Holbrook, associate physical director for the Albany YMCA;

Bernard W. Hungerford, associate in physical education and recreation, New York State Education Department; Rita A. Sator, associate in secondary curriculum, New York State Education Department; and William J. Tomik, professor of physical education at the State University College at Cortland. Joanne W. Sculli, associate in physical education and recreation, and Robert Zimmerman, associate in secondary curriculum, both of the New York State Education Department, reviewed the material in several stages of its development, and their comments and suggestions have been fully incorporated. Of particular assistance were Carol Spindel, program director for the Northeastern New York Chapter, Inc., of the American Heart Association; Russell W. D'Entrone, director of youth services for the Albany Area Chapter of the American Red Cross; and Grace M. Hilt, program coordinator for the Dairy, Food and Nutrition Council, Inc. — all of whom were most generous with their time, their ideas, and their material support.

As indicated earlier, *Cardioenergetics* is designed for use in secondary schools; but since wellness is a concern for people of any age and since the development of lifestyles conducive to wellness is of special importance with regard to children, school districts are strongly encouraged to design and implement primary and/or intermediate grade programs and multi-age, community programs in physical fitness/heart disease intervention. Toward this end, the publication includes suggestions, activities, references, charts, and other resource materials which are appropriate *as is* for the development of programs of this type, or can readily be adapted. In addition, any part of this guide can be reproduced for use in education and some items, like the word search on p. 106, are specifically designed for that purpose.

Herbert Bothamley, *Chief*
Bureau of General Education
Curriculum Development

Gordon E. Van Hooft, *Director*
Division for Curriculum Services

Table of Contents

FOREWORD iii

INTRODUCTION 1
- Goals and Objectives 1
- Fundamental Concepts 2
  - THE HEART IS A PUMP 2
    - Heart Sounds 5
    - Arterial Pulse 5
    - Blood Pressure 5
  - THE EFFICIENCY OF THE HEART (CARDIOVASCULAR FITNESS) CAN BE MEASURED 6
  - THE EFFICIENCY OF THE HEART IS AFFECTED BY A VARIETY OF FACTORS 8
    - Age 8
    - Gender 9
    - Health and Fitness Levels 9
    - Changes of Environment 9
    - Body Temperature 10
    - Body Position 10
    - Sleep 10
    - Thinking and Emotion 10
    - Stress 11
    - Food 11
    - Liquids 12
    - Smoking 13
    - Drugs 13
    - Exercise 14
  - THE EFFICIENCY OF THE HEART CAN BE IMPROVED 15
  - IMPROVEMENT IN CARDIOVASCULAR EFFICIENCY IMPROVES GENERAL HEALTH 17
- Where and How to Start 18
- Facilities and Equipment 19
- Sources and Resources 20
- Pitfalls and Pointers 21
- Teacher's Notes 24

TEACHING AND LEARNING 25
- Awareness Activities 25

Three Sample Aerobic Conditioning Programs 27
GENERAL GUIDELINES 27
JOGGING — Within Regular Physical Education Classes 31
JOGGING — As An Elective Course 36
How To Begin 36
Warmup and Conditioning 37
Red, White, and Blue Level Programs 41
AEROBIC RHYTHMS 43
Guidelines for Planning Aerobic Rhythms Exercise Routines 43
Program Overview 44
Exercise I - The Warmup (Upper Body) 46
Exercise II - The Warmup (Lower Body, Including Situps) 49
Exercise III - The Warmup (Lower Body, Including Pushups) 51
Exercise IV - Aerobic Exercise 54
Exercise V - Aerobic Rhythms 55
Exercise VI - Aerobic Rhythms 60
Exercise VII - Cool-Down 61
Exercise VIII - Tension Control and Relaxation 61

Cognitive Learning Experiences 63
Program Applications and Extensions 96
Teacher-devised Activities 98

A GLOSSARY OF TERMS 99

A SELECTIVE MULTIMEDIA RESOURCE LISTING 107

APPENDIX 117
Pulse Rate Record Card 118
Standard Blood Pressures for Children and Youth 119
Energy Expenditure and Relative Value of Activities for Promoting Cardiovascular Fitness 120
Work and Energy Expenditure 121
Desirable Weights for Teen-Age Boys and Girls 122
Daily Caloric Needs 123
Simple Tests for Obesity 124
Somatotype/Personality Type Assessment Sheet 126

Introduction

The cardiovascular system performs a number of vital functions for the human body. Its primary job is to circulate blood, which brings oxygen and fuel to the living cells and removes metabolic wastes from them. Without the constant supply of oxygenated blood provided by the proper working of the system, metabolic activity would soon cease and the cells would die. The cardiovascular system is also important to the relative stability of body temperature because it mitigates the changes in temperature produced by changes in metabolism, environmental conditions, and/or muscular activity. In addition, it helps to maintain osmotic pressure, hydrogen ion concentration, and the delicate pH (acid/base) balance in the tissue fluids. Thus, the cardiovascular system performs a major role in maintaining an internal environment that facilitates the work of the human machine.

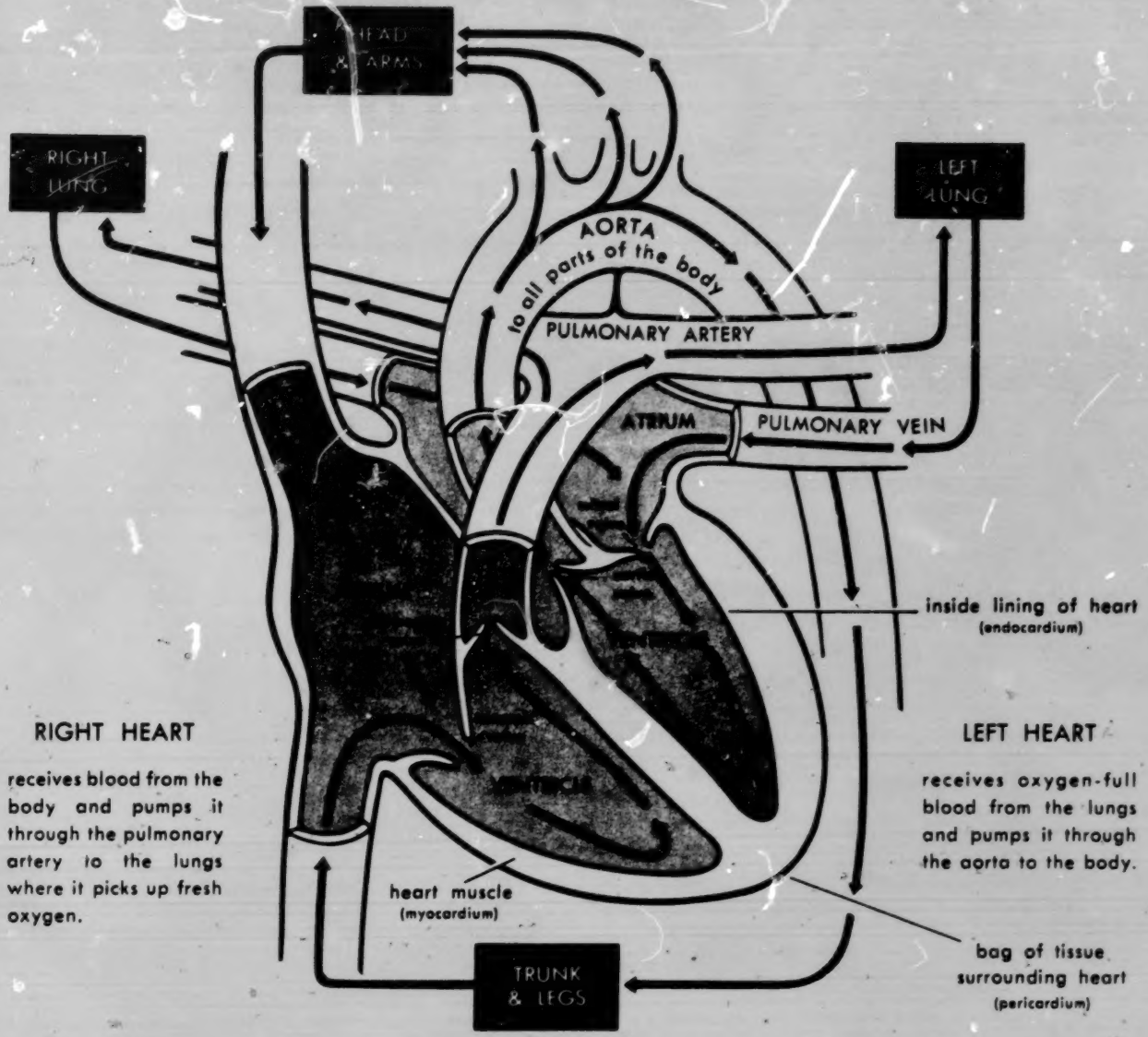
GOALS AND OBJECTIVES

Through participation in learning experiences such as those described in the second part of this publication, students should gain an understanding of the function of the cardiovascular system while the body is at rest and while it is doing work. In addition, they should begin to grasp some of the principles of energy exchange and the beneficial effects of aerobic exercise* on the cardiovascular system. These understandings should answer some of the *WHY*'s about regular physical activity and help students to make more knowledgeable decisions with regard to personal behavior and lifestyle. Specifically, the students should be able to:

- Describe the nature and function of the cardiovascular system,
- Explain why there are individual differences in cardiovascular function,
- Demonstrate and/or illustrate the effects of physical activity on cardiovascular function,
- Develop simple techniques for evaluating cardiovascular fitness,
- Use principles of and methods for developing and/or maintaining cardiovascular fitness in their everyday lives, and
- Identify the relationships between cardiovascular fitness and health maintenance.

*Physical activity (e.g., jogging, swimming, cross-country skiing) which is energized by the oxygen-dependent metabolic systems within the muscle, thereby challenging the respiratory (oxygen-intake) and cardiovascular (oxygen-transport) systems, and improving the general efficiency of all the oxygen-utilization systems in the body.

YOUR HEART AND HOW IT WORKS



RIGHT HEART

receives blood from the body and pumps it through the pulmonary artery to the lungs where it picks up fresh oxygen.

LEFT HEART

receives oxygen-full blood from the lungs and pumps it through the aorta to the body.

FUNDAMENTAL CONCEPTS

THE HEART IS A PUMP.

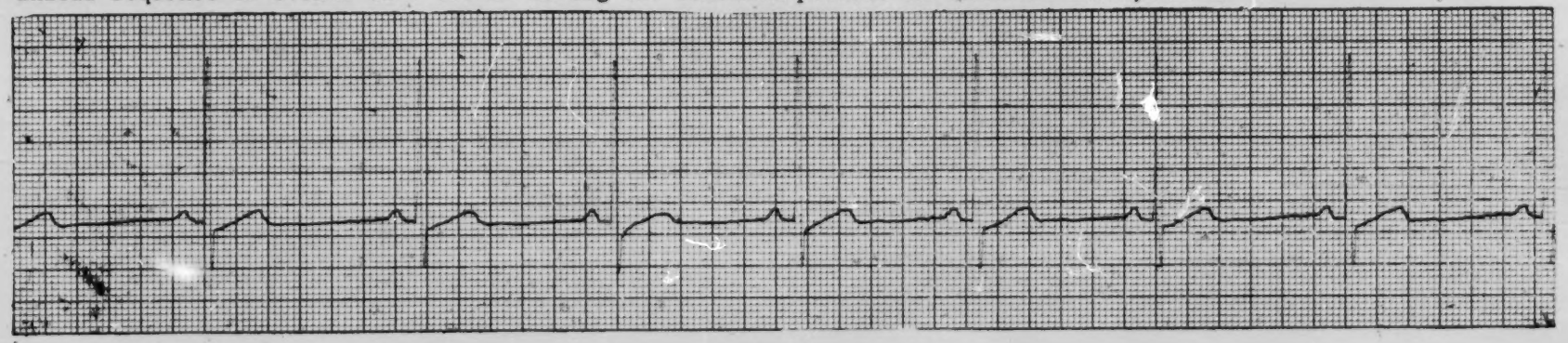
Central to the cardiovascular system is the *HEART*, a chambered muscular organ (see diagram at left) that functions as a pump to circulate blood through 100,000 miles (160,000 kilometers) of pipeline (*ARTERIES, ARTERIOLES, CAPILLARIES, VENULES, VEINS, ...*) to and from all parts of the body.

The heart is about the size of its owner's fist. It weighs about two-thirds of an ounce (19 grams) at birth; 1 1/2 ounces (43 grams) at age two; 7 ounces (200 grams) by the middle teens; and approximately 9 ounces (260 grams) for a woman and 11 ounces (312 grams) for a man at maturity. There are also changes in shape, position, and location. Prior to birth, the heart evolves from a simple tube to the familiar four-chambered, "heart-shaped" organ that lies between the lungs at the center of the chest. Initially, the heart is almost horizontal in position; but as the body grows, the chest lengthens and the narrower end of the heart

begins to drop until the wider end leans toward the right shoulder and the narrow end points downward, toward the front and left.

The heart is completely enclosed in a thin membranous sac (the *PERICARDIUM*) which has a fibrous outer coat that comes between the heart and the lungs and the wall of the chest, and a slippery, double-layered inner coat which secretes a fluid between the layers that enables the heart to move or "beat" with little friction inside its protective sac. The wall of the heart is composed of a layer of strong muscle tissue (the *MYOCARDIUM*) located between an outer layer (the *EPICARDIUM*) and a thin serous membrane (the *ENDOCARDIUM*) that lines the interior of the heart. A central muscular wall (the *SEPTUM*) divides the organ vertically into a *LEFT HEART* and a *RIGHT HEART*, each of these having an upper chamber (*ATRIUM*) and a lower chamber (*VENTRICLE*). A one-way door (the *MITRAL VALVE*), composed of two small flaps of thin, fibrous tissue which separate the left atrium from the left ventricle, limits the flow of blood to one direction: from the upper to the lower chamber. A similar exit (the *TRICUSPID VALVE*), made of three small triangular flaps of fibrous tissue, permits the unidirectional flow of blood from the right atrium to the right ventricle. The mitral and tricuspid valves are also called the *A-V VALVES*.

In essence, the heart functions as a double pump in a vast, closed, and brilliantly designed hydraulic system. Dark, bluish-red blood from all parts of the body enters the right atrium via the *SUPERIOR VENA CAVA* and the *INFERIOR VENA CAVA* and flows (1) through the tricuspid valve into the right ventricle; and from there (2) through a *SEMILUNAR VALVE* into the *PULMONARY ARTERY*, which branches into a network of arterioles and capillaries; until it (3) reaches the *ALVEOLI* in the lungs, where its carbon dioxide is exchanged for oxygen. The newly oxygenated blood returns to the heart on the left side via capillaries, venules, and the *PULMONARY VEINS*. From the left atrium, it flows through the mitral valve into the left ventricle, which pumps it through another semilunar valve (the *AORTIC VALVE*) into the master artery (the *AORTA*) which branches into a massive irrigation system that services all parts of the body. (Because the *CORONARY ARTERIES* are the first offshoots of the aorta, the heart consistently receives the freshest, best-oxygenated blood available.) The two sides of the heart operate simultaneously; that is, the left and right atria relax and fill, then contract and empty, the blood flowing through the mitral and tricuspid valves into the relaxed and receptive ventricles. Tenths of a second later, the ventricles contract, the left ventricle sending a surge of nutrient-filled, oxygen-saturated blood to all the tissues of the body and the right ventricle propelling oxygen-deficient blood to the lungs. The relaxing/filling phase is called the *DIASTOLE*; the squeezing/emptying phase is called the *SYSTOLE*; and the term *HEARTBEAT* is used to describe the mechanical sequence of events that occurs during the combined periods of diastole and systole.

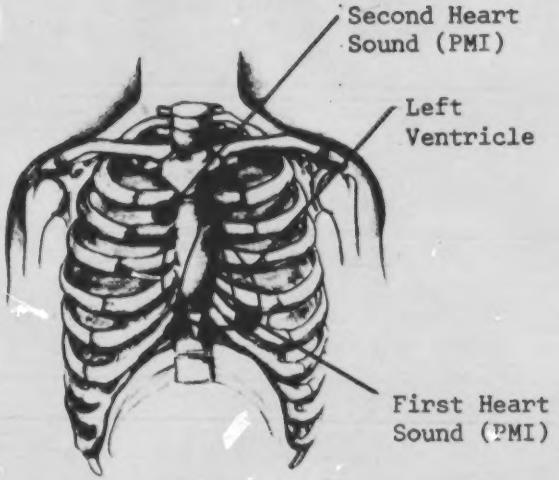


A TRANSPORTATION WORKER SPEAKS

GOOD EVENING, FOLKS. THIS IS YOUR ON-THE-SPOT REPORTER, WALTER KRUMKITE, WITH ANOTHER UNUSUAL INTERVIEW.
TONIGHT WE ARE ON THE LIFE LINE THRUWAY WHERE TRAFFIC IS REALLY HEAVY. WE ARE GOING TO INTERVIEW... AH... HERE COMES ONE NOW.
EXCUSE ME, SIR. WOULD YOU MIND ANSWERING A FEW QUESTIONS FOR OUR MILLIONS OF FANS OUT THERE IN HEARTLAND, U.S.A.?
HEY, YOU'RE WALTER KRUMKITE, AREN'T YOU? OK, KRUM. ASK ME ANYTHING. BUT MAKE IT FAST. WE BLOOD CELLS MAKE TWO ROUND TRIPS THROUGH THE BODY EVERY MINUTE. THAT'S TWO TRIPS A MINUTE, BROTHER.
HEY, YOU ARE FAST.
NO, I'M RED. RED CELL IS WHAT THEY CALL ME, KRUM.
WELL, RED. WOULD YOU MIND TELLING OUR FANS OUT THERE IN TV LAND EXACTLY WHAT YOU DO?
I WORK, MAN. I DRIVE UP THROUGH THE LUNGS AND PICK UP A LOAD OF OXYGEN. THEN I PASS THROUGH THE HEART, TAKE AN ARTERY, AND DRIVE THE OXYGEN TO A FINGER OR TOE OR SOMETHING AND DUMP IT.
WHERE DO YOU GO FROM THERE?
I LOAD UP AGAIN-- ONLY THIS TIME WITH WASTES-- STUFF THE BODY WANTS TO GET RID OF-LIKE CARBON DIOXIDE. THEN I HOP ON A VEIN AND HEAD BACK TO THE HEART.
WELL, RED, YOU SURE KEEP BUSY.
BUSY! LISTEN, KRUM. WE RED CELLS WORK OURSELVES TO DEATH. THREE WEEKS-- THAT'S HOW LONG WE LAST. THREE WEEKS. THEN NEW RED CELLS COME ALONG AND TAKE OUR PLACE. WHAT WE NEED IS A GOOD LABOR UNION.
NEW CELLS? WHERE DO THEY COME FROM?
BONES. NEW CELLS ARE MADE INSIDE THE BONES. WHEN WE RED CELLS DIE AFTER THREE WEEKS WE PASS OUT OF THE BODY AS WASTE. GONE AND WHO CARES?
WE ALL CARE, RED. SAY, WHO ARE THOSE WHITE CATS SPEEDING BY?
THEM? THEY'RE THE LAW AND ORDER MEN. THEY FIGHT GERMS, HELP HEAL CUTS AND OTHER INJURIES TO THE BODY.
THERE DON'T SEEM TO BE VERY MANY WHITE CELLS.
THEY'RE ALL OUT PATROLLING. THEY TRAVEL THROUGH THE ARTERIES AND VEINS LOOKING FOR TROUBLE SPOTS. BUT YOU'RE RIGHT. THERE AREN'T AS MANY WHITES AS REDS. THERE ARE ABOUT 650 RED CELLS FOR EVERY WHITE CELL.
I SEE OUR TIME IS UP, RED. THANKS A LOT-- AND KEEP TRUCKIN'. THIS IS WALTER KRUMKITE SAYING GOOD-NIGHT AND GOOD LUCK.

(Special permission granted by *The Body Machine*, published by Xerox Education Publications, © 1975, Xerox Corp.)

HEART SOUNDS The heart sounds, which are heard by *AUSCULTATION* (listening through a stethoscope placed, in this case, on the chest wall), are echoes or reverberations of the closing of the heart valves. Since there are two sets of valves, there are two sounds to each heartbeat. The first of these is best heard with the stethoscope bell placed over the fifth left intercostal space slightly to the left of the sternum (see *PMI* [Point of Maximal Impulse] - *First Heart Sound*, on the diagram at right). It is lower in pitch, slightly longer lasting than the second heart sound, and is frequently referred to as the *Lub*. It is produced by vibrations resulting from the closing of the A-V valves at the onset of systole. The second heart sound can best be heard higher on the chest wall, over the second intercostal space to the right of the sternum (see *PMI - Second Heart Sound* on the diagram at right). It is caused by vibration of the semilunar valves as they close on completion of systole. In addition to the intensity of the heart sounds, the rate of the heartbeat and its rhythm (regular or sporadic) can be noted by auscultation with a stethoscope.



HEART SOUNDS

ARTERIAL PULSE The contraction of the left ventricle creates a wave-like surge of blood which is transmitted through the arteries and gives rise to the *ARTERIAL PULSE*. This pulsation can be felt or *PALPATED* at any of several locations on the surface of the body, and is named for the arteries which are nearest to the area palpated (e.g., the *RADIAL PULSE* is taken on the radial artery near the base of the thumb, and the *CAROTID PULSE* is taken on the carotid artery on either side of the Adam's apple). Each time the ventricles contract, a volume of blood is propelled out of the heart, creating a pulse wave. The *PULSE RATE* reflects the number of ventricular contractions per minute, and is an indirect way of counting the *HEART RATE*. Because the pulse rate reflects the heart rate, and because the heart rate has a direct relationship to the amount of physiological work being performed, the pulse rate is often used as an index to the level of work performed by the cardiovascular system. It is measured by counting the number of times the heart beats per minute (*bpm*).

BLOOD PRESSURE Blood pressure is the force which the blood exerts against the walls of the blood vessels. It is analogous to the air pressure in an automobile tire which keeps it inflated. Pressure within the closed vascular system produces blood flow. This pressure is the result of several forces, but it relates primarily to the pumping action of the heart and the elastic recoil of the vascular walls. Blood pressure is usually measured indirectly in millimeters of mercury (*mmHg*) by an instrument called a *SPHYGMOMANOMETER*. It fluctuates with each heartbeat, the highest level occurring in the period of systole (*SYSTOLIC PRESSURE*) and the lowest, during diastole (*DIASTOLIC PRESSURE*). In addition, it is affected by such factors as age, weight, body position, level of excitement and/or activity, time of day, etc. During exercise, for example, blood pressure rises in direct proportion to the intensity of activity — a change which reflects the heart's response to the increased metabolic needs of the exercising muscles. However, if the blood pressure is consistently higher than circumstances seem to require (as when the body is at rest), the individual may have "high blood pressure," a serious and widespread disease which — if undetected and/or uncontrolled — can lead to kidney damage, heart attack, stroke, and other forms of

organic disfunction. It is frequently asymptomatic; but because the person may feel quite normal, with no discomfort or pain, the American Heart Association estimates that more than 20 million Americans have high blood pressure, and that most of them are unaware of it! Of the known cases, approximately 85 percent are essential or ideopathic (of unknown cause). Even more alarming, however, is the marked increase in high blood pressure among young children, many of whom have no family history of the disease.*

THE EFFICIENCY OF THE HEART (CARDIOVASCULAR FITNESS) CAN BE MEASURED.

Since the human body is designed for work, every cell contains a microscopic combustion engine fueled and oxygenated by the blood. The cellular combustion process yields chemical energy, heat, and a variety of surplus products (metabolites), which includes carbon dioxide and water. For every liter of oxygen consumed in the process, approximately 5 kilocalories (KCAL) of energy is released. When the supply of oxygen is insufficient for the metabolic needs of the cells, an auxiliary ANEROBIC** system activates in order to help the cells to meet their energy requirements. The anerobic system is extremely limited, however, and emits a byproduct (lactic acid) which — in accumulation — diminishes further muscle cell metabolism. Thus the ability of the blood to absorb oxygen from the alveoli in the lungs, coupled with the ability of the cardiovascular system to transport it with selected nutrients to the muscle cells, governs the amount of energy produced and, resultantly, the intensity and duration of the work performed. In other words, the greater the oxygen transport ability, the greater the capability for generating energy. For this reason, the operational efficiency of the cardiovascular system is of paramount importance to the productivity of the human machine.

High levels of cardiovascular efficiency are generally characterized by:

(1) *LARGE stroke volumes* (the amount of blood pumped with each contraction of the ventricle);

(2) *LOW resting heart rates* (the number of ventricular contractions per minute when the body is not performing physical work);

(3) *ACCEPTABLE (as opposed to INORDINATE) increases in heart rate* when the body engages in increasingly vigorous aerobic activity; and

(4) *RAPID RETURN to resting heart rate levels* after vigorous physical activity, whether

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**Hypertension Screening in Schools*, a program planning guide developed by the New York State Education Department (Bureau of School Health Education and Services), is part of a concerted effort to help school health maintenance personnel to identify children and youth with high or potentially high blood pressure and refer them to qualified medical personnel for proper care and follow-up.

**Taking place without, or in the absence of, oxygen.

aerobic or anerobic.*

The most commonly accepted measure of cardiovascular fitness is *MAXIMAL OXYGEN UPTAKE* ($\dot{V}O_2$ *max*), the volume of oxygen used by the cells during physical activity at maximal heart rate levels. $\dot{V}O_2$ max is the product of *CARDIAC OUTPUT* (cardiac output [$\dot{Q}$] equals heart rate times stroke volume) and *ARTERIOVENOUS OXYGEN DIFFERENCE* ($A\text{-}\dot{V}O_2$ *diff*). These quantities are usually measured in a human performance laboratory while a person exercises on a treadmill or a bicycle ergometer. However, since this type of equipment is not readily available in most school districts, *PULSE COUNTS* (pulse rate equals heart rate, cf. p. 5), *GRADED EXERCISE TOLERANCE TESTS*, and *POST-EXERCISE RECOVERY HEART RATES* are often used to assess — and monitor — cardiovascular fitness.

Step tests are useful in measuring heart rate responses to exercise, and they require only a stopwatch or a timer and a bench of the proper height for the students who will be using it, but there are some caveats. The test may be too strenuous for students who are overweight and/or have short legs, and it shouldn't be used at all by students who have leg muscle injuries. In addition, the count must be accurate if the test is to be a valid indicator of fitness. It is therefore advisable to:

- Schedule students for another type of test if they have problems like those identified above;
- Use a graduated step with heights from 8 to 20 inches (approx. 20 to 51 cm.), depending upon the age and gender of the group;
- Select a cadence which is easy to maintain, and use either music with a strong beat or a metronome or a tape recording of the count *"UP, two, DOWN, four, ..."*;
- Train the students to count pulse rates and have them *practice* counting several times before administering the test; and
- Develop norms for evaluating fitness levels *within the school.*

A more complete discussion of step tests can be found in the *Physical Fitness Research Digest* (a publication of the President's Council on Physical Fitness and Sports), Series 5, No. 1, January 1975.

There are other ways to evaluate cardiovascular performance. Among the most familiar of these are Cooper's 12-Minute Walk/Run and 1.5-Mile Run. Both are good field tests for students in high school** or college; but

*Short-term, high-intensity "bursts" of physical activity (such as those occurring in selected gymnastic, swimming, and track and field events) which require high energy output without benefit of the aerobic cardiovascular supply system.

**See "An Aerobics Conditioning Program for the Fort Worth, Texas School District" by Kenneth H. Cooper, J. Gerry Purdy, Art Friedman, Richard L. Bohannon, Russell A. Harris, and Joseph A. Arends in *The Research Quarterly* (46:3:345-50, October, 1975). Reprints of the project report can be secured from the Institute for Aerobics Research, Dallas, Texas 75230.

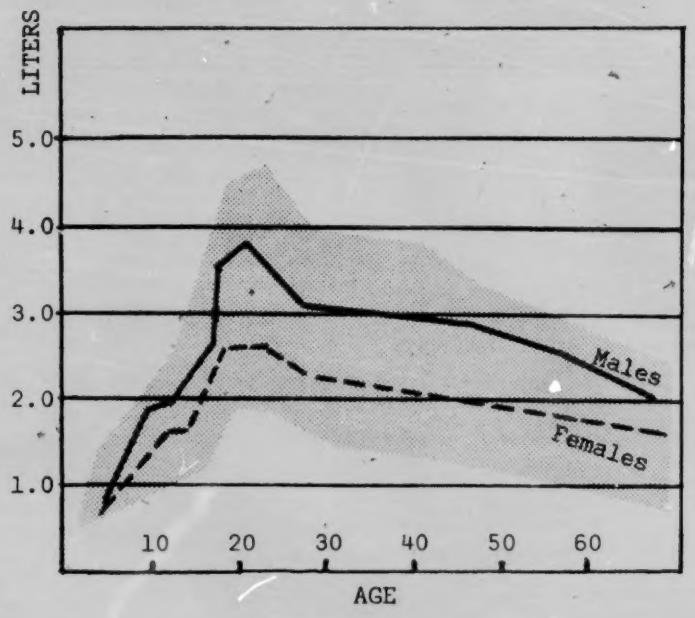
since success in each case depends upon motivation and knowledge of pace, it is important that the participants (1) practice-pace for a few periods prior to taking the test(s) and (2) understand that each of these is a *self-appraisal,* not a race. Students should be encouraged to run or jog at their own best pace, without punishing themselves. There are no published norms for children as yet; but, like those for step tests, they can be developed within the school and used as *indicators* of cardiovascular fitness, rather than norms. Another alternative is the 600-Yard Run, which correlates very well with laboratory assessments of oxygen uptake in selected junior high school students. Norms for boys and girls can be found in the American Alliance for Health, Physical Education, and Recreation youth fitness manual.*

Laboratory assessment of maximal oxygen uptake is the "best" test of cardiovascular fitness, but any of the other tests described above will produce at least a reasonable measure of cardiovascular health, and may stimulate student interest in the development and/or maintenance of a personal fitness program.

THE EFFICIENCY OF THE HEART IS AFFECTED BY A VARIETY OF FACTORS.

The efficiency with which the body's pump performs its functions is affected by a variety of factors, either singly or in combination. The following items have been given general consideration only, however, and it should be remembered that natural endowment plays a very important role in cardiovascular health.

AGE As indicated in the graph at right, maximal oxygen uptake levels rise fairly sharply between the ages of 4 and 20 and then gradually drop off, although top athletes in their 20's and beyond have been known to consume 5 to 6+ liters of oxygen per minute. The decline is related to other changes that occur with age — a reduction in lung capacity, lowered efficiency of oxygen/carbon dioxide exchange, a loss of elasticity in the vessel walls, a decrease in maximum heart rate levels (from approximately 200 beats per minute in youth to about 150 bpm at age 70), a reduction in skeletal muscle mass and muscle power, and a lowered supply of blood to the heart muscle. Thus cardiac efficiency improves with maturation, and then declines with age — although the reduction is less significant if one remains physically active.



MAXIMUM OXYGEN UPTAKE LEVELS

*AAHPER *Youth Fitness Test Manual,* 1976 edition (AAHPER Publication-Sales, 1201 16th Street, N.W., Washington, D.C. 20036).

GENDER Maximal oxygen consumption values are very similar for boys and girls up to the age of 12, but after puberty the aerobic power of boys is considerably greater than that of girls. Resting pulse rates are 5 to 10 beats faster and blood pressure levels 8 to 10 mmHg lower for girls than for boys of comparable maturity. Circumstances alter cases, however, and top female athletes have maximal oxygen uptake values which are greater than those of most men.

HEALTH AND FITNESS LEVELS People who are in good health — whether male or female, young or old — usually have lower resting pulse rates and better blood pressure levels than those who are not in good health. However, it should be remembered that health and fitness are not synonymous; that is, one can be in a reasonable state of health and still be physically or cardiovascularly *un*fit. Conversely, one can be in poor general health and yet perform a given event exceptionally well (e.g., sick athletes have been known to establish personal performance records on many occasions while sick or not feeling well). The crux of the matter is that physical or cardiovascular fitness is that quality or state of being which enables one to meet the requirements of daily living *and* cope with emergency situations without undue risk to mind or body. Thus people who are physically or cardiovascularly fit can perform greater workloads more efficiently (with fewer heartbeats) and recover more quickly from exercise and/or physiologically stressful situations than those with equally good health, but lower cardiovascular fitness levels.

CHANGES OF ENVIRONMENT Changes in temperature, humidity, barometric pressure, altitude, oxygen concentration, pollutants, and other environmental conditions have a marked effect on cardiovascular performance. For example, heat increases heart rate because physiological work is required to dissipate it, especially when the humidity is high. Under hot, humid conditions, exercise intensity should therefore be reduced and sweatsuits or clothing which restricts evaporation should definitely be avoided. People who live in tropical climates wisely take siestas during the afternoon when heat and humidity are at their peak. Cold also increases heart rate because a higher metabolic rate is needed to maintain normal body temperature. Hospital records and obituary columns alike attest to the dangers to which unconditioned/unacclimated people are liable when they exercise or perform vigorous work under hot/humid or cold/windy environmental conditions.

The atmosphere also has an impact on cardiovascular performance. For example, unconditioned New Yorkers and other people accustomed to altitudes of less than 5,000 feet (1500 meters) find it difficult to perform the same amount of physical work in a place like Denver, the "Mile High City," and cannot even breathe with ease in the mountains of Bolivia or Tibet where the acclimated inhabitants do hard physical labor. The problem is associated with a decrease in the partial pressure of oxygen at altitudes exceeding 10,000 feet (3000 meters). In this situation, normally healthy people find themselves short of breath, quickly tired out, dizzy, headachey, a little nauseous, and guilty of bad judgment. These are symptoms of "altitude sickness" or altitude ANOXIA (lack of oxygen). Another form of anoxia occurs in mines and other poorly ventilated places where interference with the source of oxygen results in a reduced oxygen content in the environmental air. *Anoxic anoxia*, as the condition is called, is a matter of growing concern where smog and pollutants in "dirty air" have already begun to interfere with the normal oxygenation system of people living and working in highly industrialized areas.

BODY TEMPERATURE Although 98.6 degrees Fahrenheit (about 35 degrees Celsius) is generally accepted as "normal," body temperatures for healthy human beings actually change as much as a degree and a half over a 24-hour period — even if the person simply lies in bed. The lowest reading occurs between one and four in the morning and the highest in late afternoon and early evening, but the specifics vary from one individual to another. A slight increase in body temperature tends to improve metabolic efficiency, which is one of the major reasons for the "warmup" period preceding vigorous physical exercise or performance. Larger increases in temperature usually decrease metabolic efficiency and lessen work capacity (e.g., people have much faster pulse rates and tire more easily when they are feverish than when their temperatures are normal). Lowered body temperatures tend to lower metabolic rate and could result in death if the core temperature falls below the essential temperature for sustaining minimal cellular metabolic activity.

BODY POSITION Body position also has a decided effect on cardiovascular performance. As might be expected, resting pulse rates are 10 to 12 bpm faster when people are upright than when they are horizontal because the cardiovascular system has to work against the force of gravity. Furthermore, since blood tends to pool in the lower extremities, standing up suddenly sometimes causes lightheadedness because the system doesn't react fast enough to the change in body position.

SLEEP Unlike its industrial counterpart, the human machine requires a periodic rest (every 16 to 18 hours, on the average) in order to "self-renew," repair damaged tissue, and, in general, prepare for the proper functioning of all its parts. Nonetheless, the cardiovascular system must continue its work at all times — albeit at a generally reduced pace. Since the heart rate slows to some degree during sleep, the period of diastole is lengthened, giving the heart more time to rest between beats. The amount of sleep required and the time when it is most beneficial vary from one individual to the next, but the fact that one becomes programed with regard to sleeping and waking is most evident in the jet lag following too swift and radical a change in time zones. Thus the body not only needs a periodic rest, but also a certain *consistency* in the resting periods, in order to perform its many functions efficiently and well. Therefore, sleep has a positive effect on cardiovascular fitness—especially *restful* sleep. The heartbeat, blood pressure, and respiratory rate gradually decrease when one is deep in sleep, respond to the psychomotor stimulus of dreams, and gradually increase as the sleeper approaches waking.

THINKING AND EMOTION Thinking and emotion are nonexertional or internal forms of physiological work. Both can increase heart rate in much the same way as any other form of work. In fact, experiments have demonstrated that when people engage in an activity vicariously (e.g., *think through* a golf stroke, *imagine* themselves on bicycles, or *become deeply engrossed* in a movie or spectator sport), their nerves and muscles respond as though they were physically involved in the activity — and there are corresponding changes in pulse rate. If the thoughts are accompanied by emotion, as they usually are, the effort — and the cardiovascular response — are greater. The situation is also true in reverse: if one thinks "quiet thoughts," imagines the color black or gray, or simply wipes the mental slate clean and thinks of nothing, there is a gradual relaxation of the nerves and muscles and a corresponding decrease in heart and respiratory rate. The deliberate acceleration/deceleration of muscle activity, respiration, and heart rate through "thought control" is a fundamental principle of scientific relaxation.*

*Edmund Jacobson, M.D., Ph.D., *Teaching and Learning: New Methods for Old Arts* (Chicago: National Foundation for Progressive Relaxation, 1973).

It should be noted that the increase in heart rate produced by emotional excitement, stress, smoking, stimulants, isotonics, etc., will *not* produce the improvements in cardiovascular function that result from aerobic exercise. The key difference lies in the volume of blood returned to the heart through the veins (*VENOUS RETURN*). During aerobic exercise, the peripheral musculature acts as an auxiliary pump to augment the flow of venous blood back to the heart, thereby increasing the amount of blood that fills the ventricular chambers during diastole. During systole, the volume (resistance) against which the ventricular walls must contract is concomitantly increased. This results in an *OVERLOAD* (see p. 15), an essential ingredient for the improvement of skeletal or cardiac muscle functioning. Over time, the effort required to contract against the overload strengthens the heart muscle and increases the volume of blood propelled from the heart with each contraction of the ventricular walls (increased stroke volume). Increased strength of contraction plus larger stroke volume equals improved cardiac efficiency. It is far more efficient for the heart to pump fewer times with a large stroke volume than many times with a small stroke volume to effect a given cardiac output. Since the elevated heart rates produced by emotional excitement, etc., are *not* accompanied by an increase in venous return, they do little to improve cardiovascular efficiency and can, instead, decrease it.

STRESS Sustained tension or "psychic stress" can be very damaging to cardiac efficiency because it increases heart rate, tightens or constricts the blood vessels (elevating blood pressure), interferes with sleep, and generally results in physical and emotional fatigue. During prolonged stress, the metabolic rate is continually accelerated and the human machine runs ceaselessly in high gear, without an idling period when repairs can take place. The wear and tear on the cardiovascular system are considerable during these periods, and the propensity for breakdown at its highest, particularly if the system was operating at less than optimal levels beforehand. The situation is compounded by the fact that people who live under and/or have difficulty coping with stressful conditions — and these include an incredible number of children and youth — frequently turn to nibbling, smoking, drinking, and/or drugs as palliatives, which not only have adverse effects on cardiovascular function but also tend to create habits that are difficult to break.

FOOD Cardiovascular function is affected by the *type* as well as the *amount* of food ingested. For example, some foods are harder to digest than others; some are higher in calories and/or cholesterol; and large meals take longer to digest and assimilate than small ones. Excess caloric and/or cholesterol intake can — with time — result in obesity* and/or atherosclerosis,** two of the major predisposers to cardiovascular disease. Obesity frequently results from an imbalance of energy input (food) and energy output (activity), because the unused caloric energy — whether in the form of fat, carbohydrate, or protein — is efficiently stored as *ADIPOSE TISSUE* or fat. Excessive adiposity places an unnecessary burden on the cardiovascular system because the additional fatty

*Excessive body weight due to stored fat; a condition in which more than 30 percent of the body's total weight consists of stored fat (adipose tissue).

**A disease of the blood vessels characterized by a narrowing of the arterial passages as a result of the focal accumulation of lipids, complex carbohydrates, blood and blood products, fibrous tissue, and calcium deposits in the internal lining of the arterial walls.

tissue:

- Increases the amount of body mass which must be serviced by the system;
- Adds to body weight, thereby increasing the amount of inertia and gravitational force which must be overcome when the body moves; and
- Accumulates beneath the internal lining of the arterial walls, leading to atherosclerosis.

Finally, cardiovascular function is affected by the work involved in *processing* caloric energy. That is, the system's activity increases when food is eaten, transported, converted, metabolized, and/or stored.

LIQUIDS Liquids have a great deal of influence on cardiovascular function. For example,

- *Water* is essential for control of body temperature and blood volume/fluid balance. Since 70 percent of the body by weight is water, the delicate balance of extracellular and intracellular water must be maintained within rather narrowly defined limits if optimal functioning of the body is to occur during physical exercise.
- *Electrolyte solutions*, consumed before, during,* and/or after exercise may help to minimize cramps and maintain stable internal environment during prolonged physical work or athletic competitions.
- *Stimulants* such as coffee, tea, and cola-type beverages which contain caffeine increase heart rate, raise blood pressure, and generally excite the central nervous system. When consumed in quantity, they generally exert a negative influence on cardiovascular function by unnecessarily elevating heart rate and blood pressure during physical work.
- *Beverage alcohol*, which is classified as a food (because it contains caloric energy) and as a drug (because it affects the central nervous system), exerts a varied influence. Since more than 90 percent of the alcohol taken into the body is metabolized (releasing approximately 7 calories of energy for

*One of the most dramatic and relatively recent contributions of research in the area of fluid "balance" and cardiovascular function has been concerned with fluid intake *during* prolonged physical work or athletic performance. Once prohibited during vigorous exercise, fairly generous amounts of fluid (water or a weak electrolyte solution with a glucose content of less than 2.5 gm/dl that is cool, palatable, and slightly hypotonic) are now strongly recommended to counteract potentially dangerous effects of dehydration during extended periods of physical work. Since body temperature rises significantly during rigorous physical exertion, the body's cooling system tries to maintain normal temperature by dissipating heat through perspiration/evaporation. When the fluids lost in this manner are not replenished (and losses of nearly 2 liters/hour have been recorded during heavy work), the evaporation process slows and the body's temperature rises. The increase in temperature places an even greater burden on a cardiovascular system already taxed by the demands of the physical exertion. If the activity continues without fluid replenishment (preferably taken *before* as well as *during* and *after* prolonged effort), heat exhaustion, heat stroke, and, in extreme cases, death may occur.

every gram consumed), the extent to which alcohol affects the nervous and cardiovascular systems depends upon individual tolerance for it and its concentration in the bloodstream. Low levels of alcohol in the bloodstream gradually produce a mild, tranquilizing effect, but greater concentrations may profoundly "tranquilize" physiological function as well as dilate the peripheral vasculature which shunts blood to the skin, causing the body to lose heat. Alcohol first increases, then decreases blood pressure and coronary blood flow. Over time, large consumptions of alcohol may contribute to obesity, malnutrition, and central nervous system depression, and may ultimately destroy tissues of the digestive system (especially in the liver) and the brain. Because it takes about 2 hours for the human body to metabolize a shot (16 grams) of alcohol, people who space their drinks are less liable to suffer the short-term effects described above than people who exceed their alcohol catabolism rate.

SMOKING Smoking unquestionably exerts a deleterious effect on cardiovascular function. The nicotine in tobacco and the carbon monoxide the tobacco liberates on combustion increase both blood pressure and heart rate (the resting pulse rates of habitual smokers are 10 to 20 bpm faster than those of nonsmokers). Hemoglobin, the oxygen-carrying compound in the red blood cells, has a much greater affinity for carbon monoxide than for oxygen. In addition, carbon monoxide and oxygen attach themselves to the hemoglobin molecule at the same binding site. Since the two gases compete for the same site and since hemoglobin has a greater affinity for carbon monoxide than for oxygen, carbon monoxide effectively blocks the oxygen from adsorption to the red blood cells. Since a 5-to-10-percent carbon monoxide level in the blood significantly interferes with the oxygen transport/release system (and heavy smokers have levels up to 20 percent), a smoker's blood is oxygen-poor and the heart, brain, and other vital organs which depend upon it function at reduced efficiency. The situation is compounded by the fact that tobacco tars gradually coat the inner lining of the lungs, seriously impeding the oxygen/carbon dioxide exchange in the bloodstream. The body tends to compensate for reduced oxygenation by manufacturing additional red cells, but the increase in cells causes an increase in the thickness or viscosity of the blood, and thicker blood tends to clot more readily than normal blood. In addition, smoking seems to "age" the blood prematurely, for the blood of a heavy smoker who is 30 years old is almost indistinguishable (in physio-chemical characteristics) from that of a nonsmoker more than twice as old.

Smokers have a 50-to-100-percent greater chance than nonsmokers of having heart attacks or strokes, and more severe cases when they do occur. According to the American Heart Association, there is no such thing as a "safe cigarette." Filters can limit the amount of tar that passes into the lungs, but they can neither eliminate the nicotine nor decrease the carbon monoxide content.

DRUGS Drugs produce a variety of effects on cardiovascular function. Some have a direct influence on the heart. For example, propranolol (inderal) slows the heart rate, concomitantly decreasing the work of the heart, and therefore is often prescribed after a heart injury. *SEDATIVES* or "downers" (frequently *BARBITURATES*) also tend to slow the heart rate. *AMPHETAMINES* or "uppers" have the opposite effect: they speed it up. Epinephrine also stimulates heart rate, and digitalis is used by patients with heart disease to strengthen heart action. Other drugs exert their influence on the blood and therefore affect the rate and work of the heart indirectly. For example, thrombin (a *COAGULANT*) tends to "thicken" the blood by promoting clotting, while heparin (an *ANTICOAGULANT*) tends to "thin" it by discouraging clotting. Still other drugs affect the rate and work of the

heart by having an impact on the vascular system. For example, nitroglycerine (a *VASODILATOR*) dilates or enlarges the coronary blood vessels and epinephrine, which also dilates the coronary vessels, acts as a *VASOCONSTRICTOR* to contract or shrink other parts of the system, such as the vessels in the skin.

EXERCISE All forms of exercise affect cardiovascular function. Most tend to improve it, but many are not particularly beneficial and some are even detrimental, especially for people with known cardiovascular problems. Short-term, high-intensity activities with rapid, dynamic movements (sprinting and other "explosive" types of activity) produce immediate, inordinate increases in pulse rate and blood pressure. Isometric activities such as wrestling, waterskiing, and weightlifting produce small increases in pulse rate but large increases in blood pressure, and therefore are *not* recommended for improving cardiovascular function. *AEROBIC* activities, however — if properly selected and performed — have a positive effect on cardiac efficiency because they:

- Increase the size of the heart and the arterial blood vessels, the strength of the heart muscle, total blood volume, stroke volume, hemoglobin and red blood cell mass, the number of functional capillaries, electron transport capacity, fibrinolytic capability, arterial oxygen content, peripheral blood distribution, and maximal oxygen uptake;

- Decrease glucose intolerance, platelet stickiness, arterial blood pressure, heart rate (resting and at given work loads), propensity for dysrhythmias and neurohormonal overreaction, and vulnerability to strain associated with psychic stress;

- Enhance the production of myoglobin (a substance in the cardiac and skeletal musculature that is capable of combining with and storing oxygen) while decreasing sympathetic tone (which lessens the myocardium's need for oxygen);

- Increase the metabolic efficiency of the skeletal musculature, which improves its ability to extract and employ oxygen during physical work;

- Lower serum beta lipoprotein and triglyceride concentration while increasing serum alpha lipoprotein fraction, the result being a favorable change in serum lipid profile with reduced atherosclerotic propensity;

- Favorably influence body composition by increasing skeletal muscle mass and decreasing adipose tissue; and

- Improve neuromuscular coordination which, in turn, reduces the amount of energy required to perform a given workload because efficiency of movement is improved.

Research performed during the past half-decade has increasingly emphasized the importance of the improvement in metabolic efficiency of the skeletal musculature as a major contributor to enhanced heart health. The skeletal musculature of physically conditioned individuals adapts to chronic exercise. Cellular enzymes and substrates associated with oxygen extraction and utilization improve their efficiency and result ultimately in a *sparing*

effect in terms of the work of the pump. Less blood needs to be pumped for any given amount of work performed, when more of the oxygen and nutrients delivered can be extracted and utilized by "conditioned" skeletal muscle cells.

THE EFFICIENCY OF THE HEART CAN BE IMPROVED.

Many of the factors that affect the efficiency of the cardiovascular system are related to lifestyle and therefore subject to change. These factors are not biologically or genetically "fixed," but are instead governed by individual choice. Positive or favorable modifications in behavior can therefore improve the health and efficiency of the heart, and generally maximize the efficiency of the entire cardiorespiratory system. Such modifications might be adapted from the following preventive care practices:

Be Happy - try to prevent those situations which create or magnify the tensions in your life.

Eat Healthy - avoid "junk" foods and make appropriate selections from dairy, meat-and-fish, fruit-and-vegetable, bread-and-cereal, and dessert-and-snack foods.

Play Hard - get plenty of exercise every day doing the things you like to do.

Sleep Well - try to get 6 to 8 hours of restful, uninterrupted sleep each night.

Avoid Internal Pollution - don't smoke, limit (or eliminate!) your consumption of alcohol, and use drugs only in accordance with a doctor's prescription.

However, marked improvement in cardiovascular efficiency requires more concentrated effort. A well-designed and intelligently implemented program of aerobic exercise, coupled with sufficient amounts of rest and appropriate choices of food and drink, can do much to achieve that end — if the following criteria are observed:

- *The activity should involve large muscle groups in a dynamic and rhythmic manner* (jogging or swimming, as opposed to isometric exercises) in order to challenge the oxygen transport system.
- *The activity should be intense enough to accelerate the heart rate beyond certain threshold levels*, i.e., to attain a predetermined minimal heart rate. (The *OVERLOAD CONCEPT* — see Karvonen Training Stimulus Formula on the following page).
- *The activity should be sustained for 15 to 30 minutes.* It may be continuous or intermittent, performed indoors or out, the key being the maintenance of the heart rate at a level equal to or above a predetermined target rate.
- *The activity should be performed at least three times a week, preferably every other day.*

As cardiovascular fitness improves, the exercise dose/response should be reassessed and modified in accordance with the progress demonstrated.

KARVONEN TRAINING STIMULUS FORMULA

The Formula	*An Example* (15-year-old)
(1) Subtract your age from 220.	(1) 220 - 15 yrs. = 205
(2) Take your pulse when you're relaxed (resting heart rate) and subtract it from the value determined above.	(2) 205 - 70 bpm = 135
(3) Find 60 percent of the value determined in (2).	(3) 135 x .60 = 81
(4) Add your resting heart rate to the value determined in (3). This is your *TRAINING STIMULUS* or the optimum heart rate at which you should exercise for a period of 15 to 20 minutes in order to improve or maintain your cardiovascular fitness.	(4) 81 + 70 = 151 *TS*
(5) Determine your *MAXIMUM HEART RATE* by taking 85 percent of the value determined in (1). This defines the upper limit of your *TARGET ZONE*, the range within which you can exercise safely and still achieve a positive cardiovascular effect.	(5) 205 x .85 = 174 HR_{max}
(6) Determine your *MINIMUM HEART RATE* by taking 65 percent of the value determined in (1). This defines the lower limit of your target zone and represents the lowest heart rate level at which your exercise routine will produce a positive cardiovascular effect.	(6) 205 x .65 = 133 HR_{min}

Unfortunately, some of the more popular recreational activities in the United States (bowling, golf, softball, volleyball, etc.) are not of sufficient intensity, frequency, or duration to serve as good aerobic exercise. Others (tennis, racquetball, handball, basketball, football, and most team sports) provide intermittent — even

sporadic — aerobic exercise, and therefore do not meet the minimal dose/response criteria mentioned earlier. However, no single activity is exclusively aerobic or anerobic, although all activities have both aerobic and anerobic characteristics. Thus predominantly anerobic activities such as power lifting and gymnastics place some demands on the aerobic system, and predominantly aerobic activities like jogging and swimming can easily become anerobic if the rate at which the activity is performed exceeds the performer's aerobic capacity. The primary factor is the *INTENSITY (rate)* at which the activity is performed. *The best results in terms of cardiovascular conditioning come from appropriately vigorous aerobic exercises performed in a continuous and rhythmic manner for an individually specified length of time on a regular basis (preferably every other day) and at a rate or intensity below the point at which the activity becomes anerobic.* Weight training, circuit training, and calisthenics can contribute to the improvement of cardiovascular fitness, if performed correctly, but they are not specifically recommended for either developing or maintaining cardiovascular fitness. Flexibility exercises (including calisthenics) are excellent for warmup activities, however, and should precede aerobic activities to insure a relatively safe, injury-free, and enjoyable experience.

Exercise programs for the improvement of cardiovascular function should follow certain general principles (target heart rate, systematic progression of activity, etc.) whether the participants are children, young athletes, mature adults, senior citizens, or post-coronary patients, but *the specific parameters of the regimen should be tailored to the age, health status, and fitness level of each individual.* That is, the type, intensity, duration, frequency, and progression of the exercise should be prescribed for each person in accordance with selected conditions and characteristics, many of which can be determined by appropriate pretests. Once a regimen has been prescribed, the participant's progress should be monitored and the regimen adjusted accordingly until optimal levels of fitness and cardiovascular efficiency *for that individual* have been attained. (Among the benchmarks of an aerobically trained individual are the following: (1) less disturbance of baseline levels of circulation and respiration for given levels of exercise; (2) greater capacity for all types of physical activity, but particularly for endurance-type exercise; and (3) more rapid recovery from exercise of any type.) At this point, the participant can be shifted to a maintenance program in which lower training stimuli are used or the frequency of training is reduced. *However, if training is discontinued, a deconditioning phenomenon will take place and the training benefits will slowly be reversed.* For this and other reasons, people — especially children and youth — should be encouraged to make regular exercise an integral part of their daily routine or lifestyle. *Fitness cannot be stored.*

IMPROVEMENT IN CARDIOVASCULAR EFFICIENCY IMPROVES GENERAL HEALTH.

As indicated earlier, the cardiovascular system performs a number of vital functions for the human body. Its work is essential for maintaining an internal environment which facilitates the work of all the other systems of the body. In addition, the major means of improving cardiac efficiency — appropriate exercise and nutrition — can significantly reduce the potential for lifestyle-related disturbances in circulation and/or metabolic function. Finally, people who exercise regularly report that they sleep well and are better able to cope with stressful situations than they were before they began their own "health programs." Thus, people with strong, efficient hearts — people of all ages who are cardiovascularly fit — tend to feel better, look better, and perform better than their sedentary counterparts. They may also add years to their lives, but, more importantly, they add life to their years.

WHERE AND HOW TO START

The material in the preceding section is intended to provide (1) a mini refresher course for the teacher, (2) an information base for an activity-centered fitness program, and (3) the foundation for an elective, independent, or work/study course in cardiovascular health or exercise physiology. Ideally, fitness education should be infused into the total physical education program from kindergarten through adulthood, with appropriate reinforcement activities in health, science, and the other disciplines. However, it might be initiated as a special unit in physical education at one or more grade levels, offered as a training course for potential athletes, or combined with an adult physical recreation program during late afternoon or early evening hours. In any event, both content and approach should be adapted to the students' interests, maturation level, and activities both in and out of school. For example, primary and elementary school programs should include a variety of basic movement experiences designed to promote perceptual/motor development, build strength and endurance in all major muscles including the heart, and enhance the natural delight that children find in physical activity and feeling good. Skipping, dribbling, jumping rope, hula-hooping, and many other "fun" type activities should be included wherever possible within the sequence of recommended events that constitute the basic exercise routine for children. Fundamental concepts about health, physical education, and safety should complement and whenever possible derive from the movement experiences. During the middle school years (grades 4 or 5 to 8 or 9), the exploratory movement and cognitive learning experiences should coalesce into a *habit* of regular physical/recreational activity and a body of knowledge that will shape the students' voluntary choices in lifestyle. Because peer influence is particularly strong at this time, it is imperative that the experiences be sufficiently *significant for the students* to impact their lifestyles in health-promoting ways. Secondary school programs should be marked by *application* and *extension*. Having developed the habit of physical/recreational activity and acquired the information which relates that activity to the operation of their own minds and bodies, the students should begin to apply these things to involvement in specific sports (tennis, swimming, basketball, ...), academic activities (biology, health education, etc.), and/or career possibilities (e.g., work/study, optional education, or community service projects).

Since fitness education programs affect and are affected by other aspects of the students' lives, it is advisable to involve parents, teachers of other disciplines, and other members of the community as early and as fully as possible. Experience has shown that parents who participate in adult programs often ask why their children are not receiving the same type of fitness education in school, while those who are not in tune with its principles sometimes become defensive about their habits and may even develop antagonisms toward the school for having created a challenging situation at home. In a similar vein, the professional staff may need an experience-based refresher course in fitness education in order to conduct effective, individualized programs which avoid the "Do as I say, not as I do" syndrome — for the program objectives are more likely to be achieved if the teachers model the behavior and resultant level of fitness they advocate.

Action Plan

What	Who	When	How/Where	Resources Available	Resources Needed

FACILITIES AND EQUIPMENT

Fitness education classes can be held in standard physical education facilities, with a minimum of "laboratory" equipment. This might include such items as the following:

- Anthropometric instruments — a wall chart or tape for measuring height, a scale for measuring weight, tapes for measuring girth, calipers (usually available from physics teachers, if not included in the fitness laboratory during the first year) for measuring skinfolds;
- Sphygmomanometers and stethoscopes;
- Benches of varying height (can be constructed locally);
- A metronome;
- A clock timer; and
- Stopwatches.

However, unless the cognitive learning experiences are to be given through health and/or science education, classroom/laboratory space with audiovisual capability (e.g., chalkboards; bulletin boards, easels, and/or other display equipment; draperies, shades, venetian blinds, or other room darkeners; outlets for projectors, tape recorders, and similar electronic equipment; closed circuit television or videotape equipment, if available) is highly recommended.

If possible, a second "classroom" should be equipped as a fitness laboratory where body measurement, blood pressure/heart rate counts, exercise tolerance tests, remedial work sessions requiring close supervision by competent medical and/or physical education personnel, individual workouts, laboratory experiments, and related independent study projects might be accommodated. For these purposes, any or all of the following equipment might be added to the list given above:

- A bicycle ergometer and/or a treadmill
- An electrocardiograph
- An oscilloscope
- Spirometers
- Oxygen analysis apparatus
- Physiological recording systems
- Skinfold calipers

and such laboratory supplies as paper towels, test tubes, mouthpieces, etc. Many of these items might be donated or, in the case of equipment, secured on loan from commercial enterprises and/or local medical centers. Although the arrangement of the "exercise laboratory" will vary according to the nature, size, and amount of equipment to be included, it is advisable to place the testing items away from the window wall, if there is one. In addition, if showers and dressingrooms are not accessible to the laboratory, it will be necessary to provide a small screened area where pupils scheduled for tests or individual workouts will be able to change their clothes. Finally, the "fitness facility" should also include a multimedia resource center with a variety of posters, charts, fliers, books, magazines, films, slides, tapes, etc., and equipment for using them.

SOURCES AND RESOURCES

Local community involvement and support can be of great value to the school fitness program. For example, doctors might supervise or conduct the comprehensive medical examinations, serve as consultant/advisors, speakers, and resource persons for the program, or, at the very least, give it credibility through professional endorsement. Nutritionists and dietitians might help in planning meals or preparing certain types of foods, provide information and instructional materials, and serve as lecture/demonstrators for classroom learning sessions. Hospitals, community health centers, and related institutes and organizations are excellent sources of information and materials, and may be willing to provide laboratory services, equipment, facilities and assistance for independent study projects, and other types of educational support. Voluntary health groups, most community service clubs, and some commercial organizations are very much interested in preventive health measures and might well provide financial support, equipment, and/or other resources for exemplary programs. Municipal health and recreation personnel might be interested in developing a community recreation center on or near the school grounds that would serve the school population during school hours and the other members of the community when school is not in session. Finally, as indicated earlier, parental support is especially valuable because it reinforces the students' learning and may stimulate health-promoting changes of lifestyle in the parents themselves. In any event, contact with parents and representatives from business/industry and such community groups as the following can do much to make the program a success:

Medical health groups

- Physicians' organizations
- Hospitals and medical centers
- Community health centers
- Medical emergency teams
- City and county health departments

Education groups

- Adult and community education program personnel
- College and university program personnel
- Municipal health and recreation program personnel

Voluntary health groups

- The American Heart Association
- The American Red Cross
- The Diabetes Association
- The National Tuberculosis and Respiratory Disease Association
- The Dietetic Association

Community service groups

- The YMCA and YWCA
- The Jewish Community Center
- Rotary, Lions, Elks, and other service clubs
- The Chamber of Commerce and the Junior Chamber of Commerce

PITFALLS AND POINTERS

- **Conditioning → Feeling → Attitude → Habit**

If possible, students should engage in some form of enjoyable, but vigorous physical/recreational activity for 20 to 30 minutes every day. Too brief a session, too strenuous an effort, frequent interruptions in the regimen, or long periods of time between sessions will prevent the habit from forming. Keep 'em at it — but don't push too hard, for bodies that hurt will not exercise unless there are other motivations for doing so. Like any other machine, the human body must overcome inertia, gradually increase its load, and gain momentum so smoothly that it almost achieves a frictionless "perpetual motion." This is the grace and beauty of the long distance runner, the swimmer, the skater, the dancer, etc., that will produce the feeling that forms the habit.

- **Incorporate the cognitive.**

In order to help the students to make *reasoned* choices in lifestyle, the cardioenergetics program should include *cognitive* as well as affective and psychomotor learning experiences. That is, the students' "doing and feeling" activities should be interspersed with "knowledge-centered" activities in a variety of modes, including direct instruction, in such matters as the following:

- How to "warm up" for physical activity, and why this phase is so important.
- How to evaluate the body's response to various types of physical activity, including how and when to take one's pulse.
- How to determine how much of given types of activity the body can comfortably tolerate and benefit from.
- How to prevent or deal with shin splints and other problems resulting from unaccustomed involvement in exercise.
- How the muscles receive and use energy, where that energy comes from, and how it might be used more effectively.
- How to measure both input and expenditure of energy.
- How to move (walk, run, dance, swim, cycle, ...) with maximal efficiency, smoothness, and esthetic effect.
- How to use movement techniques developed through kinesthetics to improve performance in a favorite sport or recreational activity.
- How physical activity plus proper nutrition and a sufficient amount of rest and relaxation (in short, a "total fitness" program) can improve one's appearance, attitude, fitness, and performance.

- Be attuned to student hangups.

Students may resist vigorous physical/recreational activity for any or all of the following reasons, most of which can be easily dispelled by understanding, imaginative teachers.

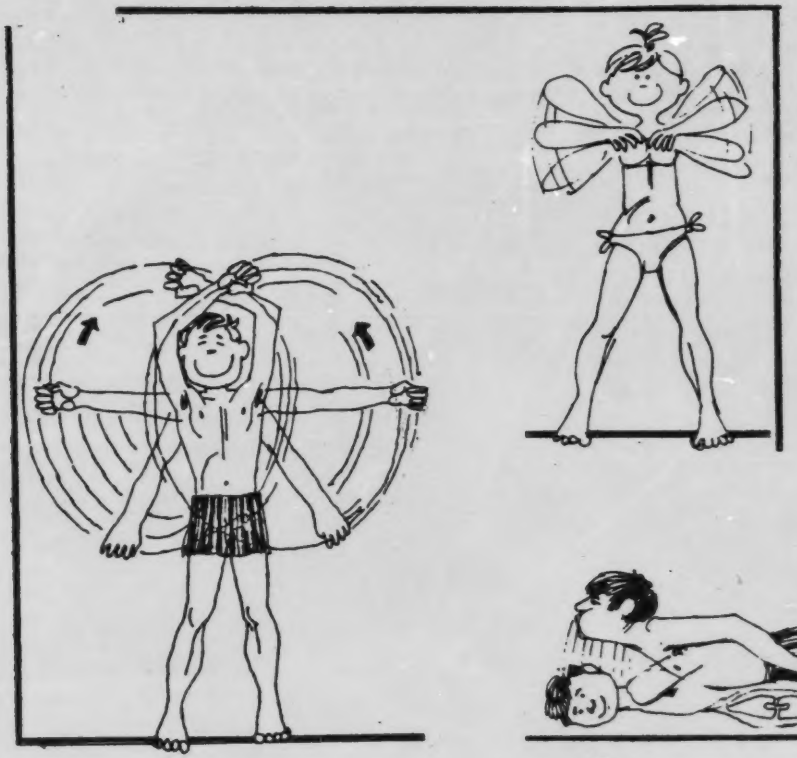
OBJECTION	COUNTERMEASURE
• *They don't like to exercise.*	• Differentiate between *exercise* and *calisthenics;* vary the regimen, including such activities as swimming, dancing, skating, etc., wherever possible; develop exercise games; have the students exercise to music, particularly popular songs or evocative classical music with appropriate rhythms; ask the students to demonstrate and explain the benefits of exercises they particularly like *or have invented;* use sports requirements and/or physical appearance (cosmetic value) as motivation; display pictures of handsome boys and shapely girls who are image-makers for the particular population with whom you're dealing; create the illusion of a "health spa" in the physical education facility.
• *They feel foolish or think they look foolish doing exercises.*	• Make aerobic exercise part of the planned class activity (e.g., relay dribbling races around cones as part of a soccer session, medley races with baton-passing as part of a track session, tag races as part of a swimming session); invite a local sports star, ballet dancer (especially a male), or instructor at a health spa to conduct one or more of the exercise sessions; encourage the students to wear leotards, jogging shorts and tee shirts, or whatever is currently fashionable and still appropriate for exercise.
• *They don't like to take showers.*	• Encourage the administration to make the shower rooms more attractive by using softly bright paint, curtain dividers in gang shower rooms for girls, soap with a masculine appeal for boys, soap with a feminine appeal for girls, and colorful posters; capitalize on soap, shampoo, and baby oil commercials to promote showering; advocate and demonstrate that "healthy American girl" or "clean-cut American male" look.
• *They feel sore or uncomfortable after exercise.*	• Begin with gentle exercise and increase the level of strenuousness gradually, so that muscles which may have had little or no recent use are trained, not strained; have the students exercise at every class session to ensure consistency and regularity, but vary the routine; encourage the students to exercise on their own between sessions, explaining that the more one exercises, the more the muscles become accustomed to exercise and the sooner they stop hurting; divert attention by having the students play exercise games or move to music they like or to stimulating rhythms.
• *They don't feel the need for exercise,* i.e., they feel healthy or at least as healthy as they care to be. Exercise—and health—are low priorities.	• Emphasize the cosmetic value of exercise for girls and the macho qualities for boys; vary the regimen, and make the exercises interesting and fun to do; develop exercise routines that can be performed by pairs or small groups of students, and encourage boys and girls to work together; use the power of rhythm. When there appears to be some genuine improvement in flexibility, strength, coordination, or whatever, have the students participate in a favorite sport or dance activity that will demonstrate how much their improvement in these areas can contribute to success in the activity.

• Have the students be their own record-keepers.

Develop a form and distribute copies to the students so that they can keep track of their own weight, girth, pulse rates, blood pressure readings, eating and other habits, input and expenditure of energy, "mileage" and/or "points" (according to Cooper's or a locally devised point system), etc. — *but keep it simple!* The entries should be easy to make, clearly visible, and readily summarized.

• Use gimmicks.

Put up signs and posters, changing them frequently. Collect and/or develop cartoons. Give "diplomas" for mileage, points, or other types of fitness achievement. Establish goals with special privileges, fun-type rewards, or recognition attached. Encourage the students to write — and fulfill — personal contracts. Develop slogans, cheers, or chants. Inspire a spirit of competition. Organize "clubs" with widely known entry-level criteria; identifying tee shirts, socks, badges, or whatever; and serious or kooky names like The Streakers, The Roadrunners, The Health Nuts, etc. Make every student a contributor, and see that he or she gets positive recognition for it.



59

60

Teaching and Learning

AWARENESS ACTIVITIES

Although identified for "awareness," such activities as the following could also be used for motivation, reinforcement, summarizing, evaluation, or whatever. They are simply examples of what might be developed as introductory, interim, or concluding experiences.

- Teach the students how to take radial and carotid pulse readings (see p. 68) and then ask them to take and record a carotid pulse reading after each item in a series of graded exercises like bench-stepping, rope-skipping, or running in place at gradually increased speeds or rhythms.

- Demonstrate the importance of blood flow by applying a blood pressure cuff to the upper part of a student's arm, tightening it until there is no pulse, and having the students observe the results. DO NOT PREVENT THE FLOW OF BLOOD FOR LONGER THAN ONE MINUTE. Ask the student to describe how the arm feels, as the others in the class note the color of the fingernail beds and the lack of pulse. What tentative conclusions might be drawn? Describe what could happen if the flow of blood were stopped for more than one minute (pain, weakness, loss of function, ultimate destruction of tissue, etc.). Relate the blood pressure "tourniquet" effect to the chest pain (angina) which is frequently associated with a heart attack. Compromised blood flow through the coronary artery "strangulates" the heart and results in the characteristic chest pain.

- Arrange for the class to visit an exercise physiology laboratory or an exercise stress testing center and have one of the students participate in a bicycle ergometer or treadmill test as the physiologist explains what is happening and why, and the other students observe. For what purposes are exercise stress tests given?

- Show a film such as *The Heart: Counterattack* (25 min. sd. color. 1972. Available from CRM Educational Films, Del Mar, CA 92014) which includes a brief description of the major causes of heart disease (esp. cigarette smoking, lack of exercise, and tension or stress), plus ways of decreasing or eliminating those causes.

- Help the students to become familiar with the structure of the heart, its operation, and various conditions that affect its operation by encouraging them to play *The Heart Game*. Superenlarge the diagram on p. 2 and paste it on a piece of backing material about the size of a Monopoly board. Then superimpose circles, squares, letters, etc., on the arrows that define the normal flow of blood and cut markers in the shape of red blood cells, polys, platelets, lymphocytes, plasma cells, etc., from oaktag or construction paper in a

variety of colors. Finally, develop a series of direction cards (like the ones outlined below) that will govern the player's progress in accordance with the effect a given condition or behavior may have on cardiovascular performance.

SKIPPED BREAKFAST *BACK UP 3 SPACES*	JOGGED 2 MILES *ADVANCE 2 SPACES*	SANG IN THE SHOWER *ADVANCE 1 SPACE*
SMOKED A CIGARETTE *BACK UP 1 SPACE*	BODY TEMPERATURE RAISED ONE DEGREE THROUGH WARMUP ACTIVITY *ADVANCE 2 SPACES*	HEART ATTACK! *YOU LOSE!*

Shuffle the cards and stack them, face down, beside the board. Have each of the players select one of the blood components as his or her marker and cast dice, draw straws, spin a bottle, or otherwise determine who will play first. Then, having selected individual starting points (HEAD AND ARMS, LEFT LUNG, TRUNK AND LEGS, or RIGHT LUNG), the players should take turns drawing cards from the pile and moving their markers along the path of blood flow according to the directions on the cards until they either complete the circuit (ending where they began) or drop from the game by "suffering a fatal heart attack" (i.e., drawing the card with a lily). The first player to complete the circuit wins the game. Learnings include the fact that (1) the cardiovascular system is a closed system without a beginning or an end; (2) certain conditions or behaviors facilitate cardiovascular performance, while others impede it; and (3) although one can do much to improve cardiovascular health and performance, there is no real guarantee against heart disease.

- Discover how much the students know about the cardiovascular system by having them play term-and-definition games like the following:

  WORD ASSEMBLIES

  Print such terms as *aerobic*, *aorta*, *bloodstream*, *diastolic*, *hypertension*, *ventricle*, etc. (see

A Glossary of Terms on pp. 99-105 for other suggestions) on small cards and cut them into syllables. Then have the students work individually or in teams to assemble cardiovascular terms from the syllables. Score one point for each bonafide cardiovascular term, and double the point value if the student (or team) can define the term as well. The highest scorer wins the game.

CROSSWORD PUZZLES

Develop a crossword puzzle with such words as *aneurism, atrium, bends, capillaries, glucose, heart, hemoglobin, systolic, veins*, etc., and have the students work individually or in teams to complete it. Make the task easier by providing a list of terms which includes, but is not limited to, the answers to the puzzle. Encourage interested students to develop their own puzzles or word games from the list.

MATCHING GAMES

Print such terms as *arterial pulse, blood pressure, digitalis, lactic acid, mitral valve, sphygmomanometer, stroke volume, vasoconstrictor*, etc., on one set of cards and the definitions of these terms on another. The cards might be color-coded (e.g., red for term and blue for definition). Shuffle the cards, scatter them on a flat surface, and have the students work in pairs or teams to match the terms with the definitions. Score one point for each correctly matched term and definition. The highest scorers win the game.

THREE SAMPLE AEROBIC CONDITIONING PROGRAMS

GENERAL GUIDELINES

Jogging/walking and aerobic rhythms offer special advantages for students in physical education classes. They are simple activities that can be enjoyed with or without particular skill development and they are convenient, require minimal equipment, and involve a limited amount of time per week, but they are excellent modalities for building cardiovascular health because they can be programed to individual levels of fitness and are easily monitored for frequency, intensity, and duration — the three "musts" for aerobic benefit. The degree of exertion in any of these modalities can be controlled by adjusting the rate, time, and, in the case of jogging/walking, the distance covered. The sample programs detailed on the following pages relate specifically to jogging/walking and aerobic rhythms, but similar plans can be developed for walking, swimming, skating, bicycling, rowing, cross-country skiing, or any other form of physical exercise which meets the criteria for genuine aerobic activity. Regardless of the mode, however, the following considerations should be included:

- *Review of medical/physical fitness records*

Ideally, this review should be completed before the students are evaluated for cardiovascular fitness and/or allowed to participate in strenuous physical activity. The school physician and/or nurse-teacher

should be involved in the review and, whenever a student's medical history and/or current health status seem to indicate, the parent/guardian and/or family physician should be consulted before the student is programed for aerobic activity.

- *Goals, objectives, and program design*

Establish goals and objectives that are within the capabilities of the individual students, and then design the program to meet them. Motivational gimmicks and individual/class incentives are strongly encouraged.

- *Entry levels*

Begin the students' activity at "underload" or "starter" levels as a leadup to the aerobic program defined by their current levels of fitness. This will minimize muscular, joint, and tendon/ligament problems.

- *Train, don't strain*

This is the Golden Rule of exercise. Olympic contenders train the year around, yet only a small percentage of their time is spent at maximum effort. Students seldom, if ever, need to go "all out" in their training.

- *Hard/easy*

Most high school physical education programs lend themselves to an alternating program of vigorous aerobic activity and rest. Again, the theme is moderation. Students will progress more rapidly and painlessly if they exercise three days a week, with light activity or rest in between.

- *Progression*

The jogger who can run a mile in 10 minutes doesn't prepare for a 7-minute mile by trying to run one every day. It is conceivable that brute force and determination might bring him or her closer to the established goal, but a healthier, surer way is to advance a little bit each day, each week, each month, using sound physiological principles as a base. The program should be gradually, but progressively, more vigorous in order to develop body tone and coordination without putting an unaccustomed burden on the heart, lungs, muscles, and other body parts. In this way, regular aerobic conditioning will become a habit, a positive addiction.

- *Plateau effect*

Improvement cannot continue forever. The students must understand that they will reach plateaus in

their development and should therefore think in terms of a maintenance program adapted to individual time schedules.

- *Togetherness*

Most of us need additional motivation to keep going on those days when we just don't feel like training. Working out with others can provide that spark and develop an esprit d'corps or team spirit that will keep the program moving if and when the initial interest flags.

- *Plan*

Encourage the students to plan their activities, particularly those that take place out of school. Working by plan helps to insure regularity, moderation, and variety.

- *Variety*

Exercise should be interesting and fun. Since the same exercises done in the same place at the same time every day can be boring, it is important to include as much variety as possible in an aerobic conditioning program. For example, joggers can work out on a track or in the hills, run fast or slow, repeat certain exercises, and do a number of other things to assess progress. Swimmers can vary their workouts by playing water polo, swimming relay races, or playing games. Aerobic dancers can create their own routines to the particular music and/or rhythms they enjoy. But students will not continue the program unless they enjoy their training activities and/or feel that they are deriving some benefit from them.

- *Retest*

Retest the students periodically. This not only evaluates the progress of the program and the individuals in it but also serves as a motivating factor as well.

- *Warmup*

Vigorous aerobic exercise should be preceded by a period of warmup. Accordingly, suggested warmups have been included in the sample programs described on the following pages, but the students should be led to understand the reasons *why* the warmup phase is so important, and some of the general principles that underlie it. For example:

(1) The muscles and the cardiovascular system must be *prepared* for vigorous aerobic activity. Thus the session should begin with gentle stretching exercises followed by walking, gentle jogging, easy swimming, or slow, rhythmic movements. The objective is to promote a gradual awakening of the system prior to rigorous exertion.

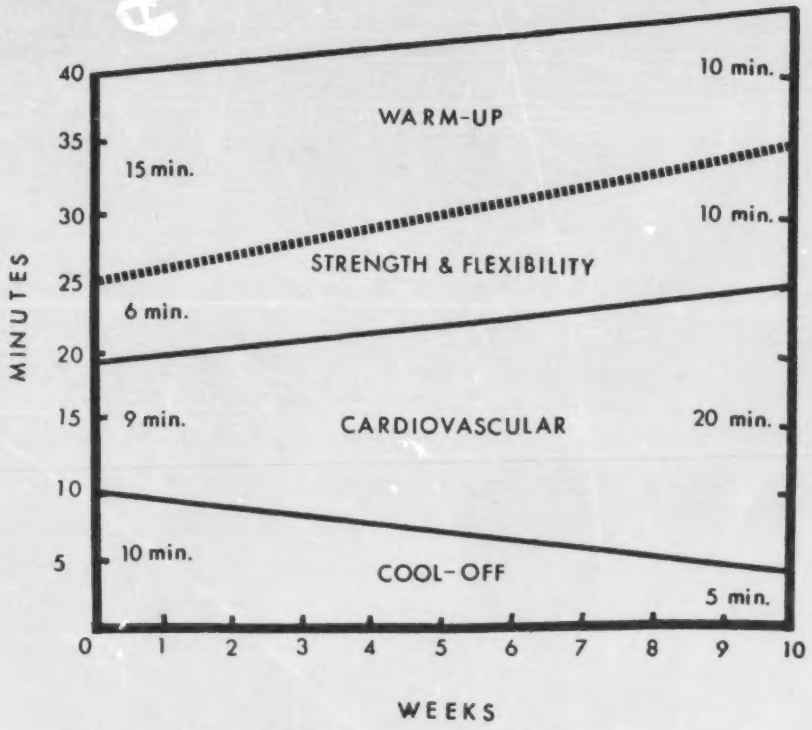
(2) The warmup activities should continue until perspiration has begun or a pulse rate approaching the lower limit of the student's target heart rate (see Karvonen Training Stimulus Formula on p. 16) has been achieved.

(3) Although the rate and intensity of performance will vary from one individual to another, the fundamental rule is to begin slowly and gradually intensify.

- *Cool-down*

Vigorous aerobic exercise should conclude with 5 to 10 minutes of cool-down activity designed to return the body to a nonexercising state. Examples have been included in the model programs, but, as with the warmup phase, students should be led to understand the reasons for and the underlying principles of the cool-down.

These might include such items as the following:



TIME ALLOTMENTS FOR DIFFERENT PARTS OF WORKOUT DURING BEGINNER'S PROGRAM

(1) Vigorous aerobic exercise involving many of the larger muscle groups of the body should never be stopped abruptly. Instead the pace and intensity of the activity should be gradually slowed in order to dissipate body heat, normalize heart rate, eliminate wastes from the tissues, and promote the movement of blood from the extremities to the heart, with the help of large skeletal muscles functioning as auxiliary pumps.

(2) Cool-down activity should be performed in a non-stressful fashion. It might include non-tensive range-of-motion/stretching movements set to music and/or performed while walking or a slow crawl, backstroke, or sidestroke (if the modality is swimming). In any case, the students should learn to relax and turn off the power.

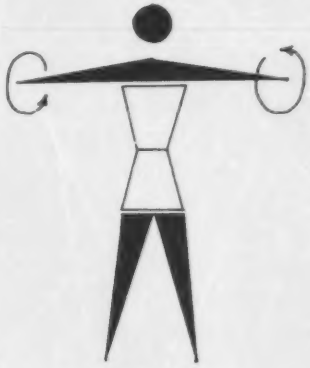
(3) The cool-down phase should continue until the heart rate drops to within 30 bpm of the individual's resting heart rate. In general, the higher the level of fitness, the lower the

amount of time needed for cooling off (see time allotments chart on preceding page).

JOGGING - Within Regular Physical Education Classes

The following pages describe a 12-week jogging program designed for use in regular physical education classes. The fitness activity progresses from 12 minutes per session during the first week to 20 minutes per session during the twelfth week, and therefore allows time for other types of learning experiences (in soccer, basketball, gymnastics, tennis, etc.) while building aerobic conditioning. In many cases, the fitness activity can be derived from and/or serve as a leadup to the individual sport/team game experiences that follow. By the end of the twelfth week, the students should be earning 15 to 18 aerobic points through class activity and should be encouraged to earn an additional 15 points on their own time.

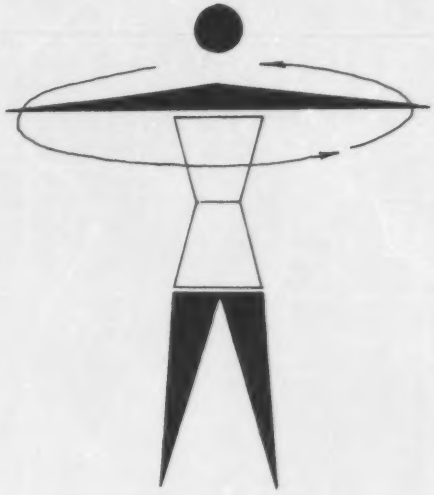
The calisthenic exercises suggested here and on the pages that follow are minimal and should be adapted, supplemented, and increased in number of repetitions whenever the conditioning needs and capabilities of the class members warrant.



ARM CIRCLES

(AC)

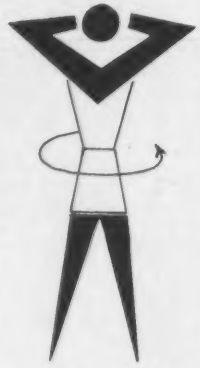
Stand erect with the feet apart and arms out to the side. Rotate arms in circles approximately one foot in radius. Do half the number recommended in one direction, and the other half in the other direction.



TWISTS

(T)

Stand erect with the feet apart and arms out to the side. Twist the trunk to the right as far as possible, and then to the left as far as possible.



TRUNK CIRCLES

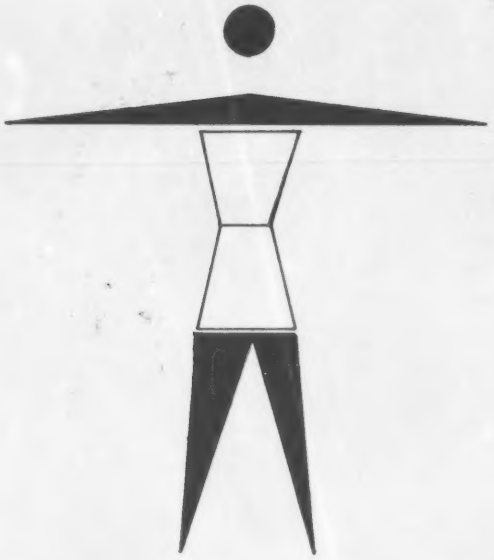
(TC)

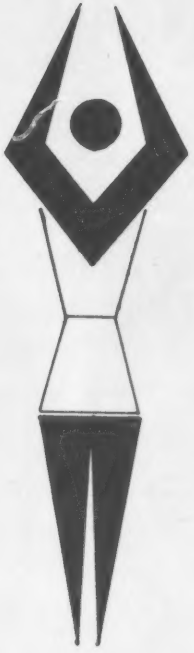
Stand erect with the feet apart and hands behind the head. Rotate the trunk to the right, keeping the feet flat on the floor. Do half the number in one direction, and the remainder in the other direction.

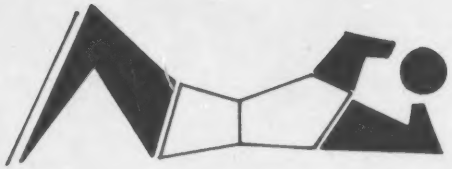
JUMPING JACKS

(*JJ*)

Stand erect with the feet wide apart and the arms out to the side. On the count of one, jump to a position with the feet together and the arms together. On the count of two, return to the original position.







SITUPS

(*SU*)

Lie on the back with the legs bent at the knees so that the feet are together and flat on the floor, the hands clasped behind the neck (hold them that way throughout).

Count 1. Tighten the abdominal muscles and sit up so that the back is approximately perpendicular to the floor.

Count 2. Return slowly to the starting position, keeping the abdominal muscles tight until the shoulders and the head rest on the floor.

Relax.

The head should lead in a "curling" motion, the chin tucked to the chest and the back rounded, not arched. Then "uncurl" back down.

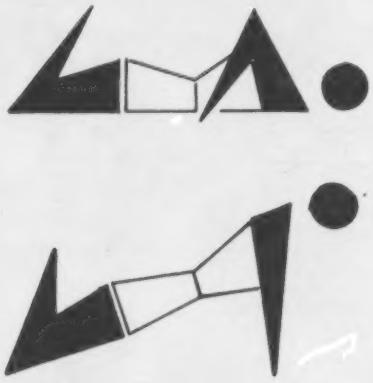
PUSHUPS

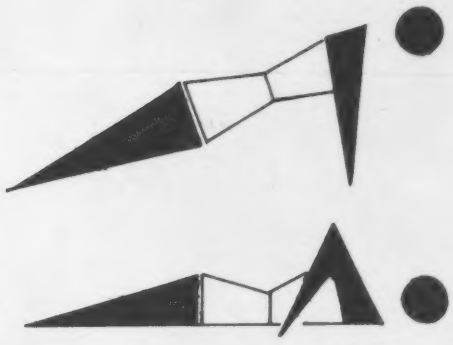
(PU)

KNEE PUSHUPS - Lie on the floor with the face down, the legs together, the knees bent, the feet raised off the floor, and the hands on the floor under the shoulders, palms down.

Count 1. Push the upper body off the floor until the arms are fully extended and the body forms a straight line from head to knees.

Count 2. Return to the starting position.





REGULAR PUSHUPS - Starting Position: Body off floor, arms fully extended so that body and legs form a straight line from head to heels.

Count 1. Lower body, touch chin only to floor.

Count 2. Push up, return to starting position.

ARM LIFTS

(AL)

Stand erect with the feet wide apart, the arms at the side, and raise the arms over the head, alternating left and right.

1ST WEEK

Day	AC	T	TC	JJ	AEROBICS	*MINIMUM DISTANCE*	*COOL DOWN*	SU	PU	AL	*AEROBIC POINTS*	*TOTAL TIME*
Monday	10	10	10	10	Jog 5-6 min. Walk, if necessary.	- -	1 min.	10	10	10	- -	12 min.
Wednesday	10	10	10	10	Jog 6 min. Walk, if necessary.	- -	1 min.	10	10	10	- -	12 min.
Friday	10	10	10	10	Jog 6 min. Walk, if necessary.	- -	1 min.	10	10	10	- -	12 min.

2ND WEEK

Monday	10	10	10	10	Jog 7-8 min., then ad lib.	- -	1 min.	11	11	11	- -	13 min.
Wednesday	10	10	10	10	Jog 7-8 min., then ad lib.	- -	1 min.	11	11	11	- -	13 min.
Friday	10	10	10	10	Jog 8-9 min., then ad lib.	- -	1 min.	11	11	11	- -	13 min.

3RD WEEK

Day	AC	T	TC	JJ	AEROBICS	MINIMUM DISTANCE	COOL DOWN	SU	PU	AL	AEROBIC POINTS	TOTAL TIME
Monday	10	10	10	10	Jog 8-9 min., then ad lib.	- -	1 min.	12	12	12	- -	15 min.
Wednesday	10	10	10	10	Jog 9-10 min., then ad lib.	- -	1 min.	12	12	12	- -	15 min.
Friday	10	10	10	10	Jog 9-10 min., then ad lib.	- -	1 min.	12	12	12	- -	15 min.

4TH WEEK

Monday	10	10	10	10	Jog 10-11 min., then ad lib.	- -	1 min.	13	13	13	- -	15 min.
Wednesday	10	10	10	10	Jog 10-11 min., then ad lib.	- -	1 min.	13	13	13	- -	15 min.
Friday	10	10	10	10	TEST DAY	- -	1 min.	13	13	13	- -	15 min.

5TH WEEK (Optional Week)

Monday	10	10	10	10	Jog 10-12 min., then ad lib.	- -	1 min.	14	14	14	3	15 min.
Wednesday	10	10	10	10	Jog 10-12 min., then ad lib.	- -	1 min.	14	14	14	3	15 min.
Friday	10	10	10	10	Jog 10-12 min., then ad lib.	- -	1 min.	14	14	14	3	15 min.

6TH WEEK

Monday	10	10	10	10	Run or Jog 11 min.	1 mile	2 min.	15	15	15	3	18 min.
Wednesday	10	10	10	10	Run or Jog 11 min.	1 mile	2 min.	15	15	15	3	18 min.
Friday	10	10	10	10	Run or Jog 11 min.	1 mile	2 min.	15	15	15	3	18 min.

7TH WEEK

Monday	10	10	10	10	Run or Jog 10 min.	1 mile	2 min.	16	16	16	3	18 min.
Wednesday	10	10	10	10	Run or Jog 10 min.	1 mile	2 min.	16	16	16	3	18 min.
Friday	10	10	10	10	Run or Jog 10 min.	1 mile	2 min.	16	16	16	3	18 min.

8TH WEEK

Day	AC	T	TC	JJ	AEROBICS	MINIMUM DISTANCE	COOL DOWN	SU	PU	AL	AEROBIC POINTS	TOTAL TIME
Monday	10	10	10	10	Run 9 min.	1 mile	2 min.	17	17	17	4	18 min.
Wednesday	10	10	10	10	Run 9 min.	1 mile	2 min.	17	17	17	4	18 min.
Friday	10	10	10	10	TEST DAY	- -	2 min.	17	17	17	4	18 min.

9TH WEEK

Monday	10	10	10	10	Run or Jog 11 1/2 min.	- -	2 min.	18	18	18	4	19 min.
Wednesday	10	10	10	10	Run or Jog 11 1/2 min.	- -	2 min.	18	18	18	4	19 min.
Friday	10	10	10	10	Run or Jog 11 1/2 min.	- -	2 min.	18	18	18	4	19 min.

10TH WEEK

Monday	10	10	10	10	Run or Jog no less than 14 min.	- -	2 min.	19	19	19	4 1/2	19 min.
Wednesday	10	10	10	10	Run or Jog no less than 14 min.	- -	2 min.	19	19	19	4 1/2	19 min.
Friday	10	10	10	10	Run or Jog no less than 14 min.	- -	2 min.	19	19	19	4 1/2	19 min.

11TH WEEK (Optional Week)

Monday	10	10	10	10	Run or Jog 14 min.	1 1/2 mile	2 min.	20	20	20	5	20 min.
Wednesday	10	10	10	10	Run or Jog 14 min.	1 1/2 mile	2 min.	20	20	20	5	20 min.
Friday	10	10	10	10	Run or Jog 14 min.	1 1/2 mile	2 min.	20	20	20	5	20 min.

12TH WEEK

Monday	10	10	10	10	Run or Jog 13 1/2 min.	1/2 mile	2 min.	21	21	21	5	20 min.
Wednesday	10	10	10	10	Run or Jog 13 1/2 min.	1 1/2 mile	2 min.	21	21	21	5	20 min.
Friday	10	10	10	10	TEST DAY	- -	2 min.	21	21	21	5	20 min.

At the end of the 12-week period, student fitness levels should be reassessed and individual programs developed for further improvement and/or maintenance of those levels. Cooper's 12-Minute Walk/Run is a useful instrument for this purpose because it incorporates the same modality as the in-class program and the results have been grouped into fitness categories as follows:

DISTANCE COVERED	FITNESS CATEGORY
Less than 1.0 mile	*Very poor*
1.0 to 1.24 miles	*Poor*
1.25 to 1.49 miles	*Fair*
1.50 to 1.74 miles	*Good*
1.75 miles or more	*Excellent*

In order to be in adequate physical condition, students should be able to run a mile and a half to two miles in the 12 minutes allowed (Fitness Category *Good* to *Excellent*). Reassessment at regular 10-week intervals may encourage the students to continue their individualized fitness programs on their own time and thereby ensure that the cardiovascular benefits of the training effect will be maintained.

JOGGING - As An Elective Course

The following pages describe an aerobic fitness program that could be offered as an elective course in physical education. It includes suggestions for assessing exercise capability and three levels of programing (labeled red, white, and blue), with calisthenic warmups. Jogging is the modality, but the program could as easily include walking, dancing, rowing, bicycling, crosscountry skiing, or any other form of genuine aerobic activity.

HOW TO BEGIN

The capacity for exercise varies widely among human beings, regardless of similarities in age and physical build. For this reason, the program described on the following pages is based on *individual ability* (rather than on what the students see others doing and/or think *they* can do) and should begin with a determination of each student's exercise capacity.

The Walk Test

The purpose of this test is to find out how long (up to 10 minutes) a student can walk on a level surface without undue difficulty or discomfort.

- Students who can walk briskly for 5 minutes without discomfort should be encouraged to try the walk/jog test described below.

- Students who cannot walk briskly for 5 minutes should begin with the *RED* level walking program described on pp. 41-42.

The Walk/Jog Test

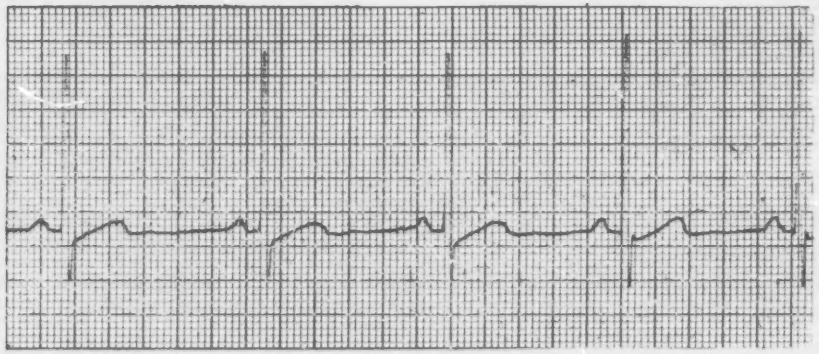
This test consists of alternately walking 50 steps and jogging 50 steps up to a total of 6 minutes at specific rates of speed. The pace for walking is 120 steps/min.; that is, both the left and the right foot should strike the ground once during each second. The pace for jogging is 144 steps/min.; that is, the left and right feet should strike the ground 18 times apiece during every 15 seconds. Students who take the test should do frequent 15-second checks on their walking and jogging intervals in order to establish and then maintain the required pace.

- Students who complete the 6-minute walk/jog test without difficulty can probably succeed in the *BLUE* level program, although it might be advisable to "warm up" for a week or two on the *WHITE* level program (see pp. 41-42).

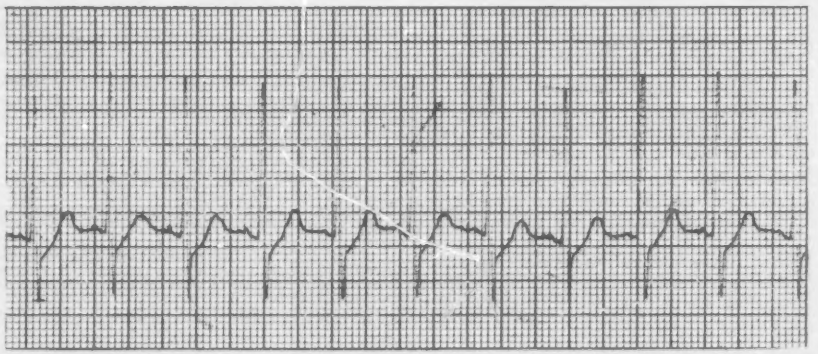
- Students who are *unable* to complete the test should plan their exercise program at the *WHITE* level.

WARMUP AND CONDITIONING

Physical workouts should always begin with an adequate warmup in order to increase body temperature and heart rate, make the joints more flexible, and cause the muscles and their attachments to become more elastic.



Resting Heart Rate



Exercise Heart Rate

THE WARMUP

(1) WALK FOR 2 MINUTES at a comfortable pace.

(2) SIDE BODY BEND

Stand with the feet a shoulder-width apart, hands extended overhead, and fingertips touching.

Count 1. Bend the trunk slowly sideward to the left as far as possible, keeping the hands together and the arms straight (don't bend the elbows).

Count 2. Return to the starting position.

Counts 3 and 4. Repeat to the right.

Red Level Program - 2 to 5 times

White Level Program - 5 to 10 times

Blue Level Program - 10 times

(3) CHEST AND SHOULDER STRETCH

Stand erect and bend the arms in front of the chest, with the fingertips touching and the elbows at shoulder height.

Counts 1, 2, and 3. Pull the elbows back as far as possible, keeping the arms at shoulder height. Return to the starting position each time.

Count 4. Swing the arms outward and sideward, at shoulder height, with the palms up. Return to the starting position.

This is bouncy, rhythmic action, counting "one-and-two-and-three-and-four."

Red Level Program - 2 to 5 times

White Level Program - 5 to 10 times

Blue Level Program - 10 to 20 times

(4) HEAD ROTATION

Stand erect with the feet a shoulder-width apart and hands on hips.

Count 1. Slowly rotate the head in an arc from left to right.

Count 2. Slowly rotate the head in the opposite direction. Use a slow, smooth motion and close the eyes to help avoid losing balance or getting dizzy.

Red Level Program - 2 to 10 times each way

White Level Program - 10 times each way

Blue Level Program - 10 times each way

(5) FORWARD TRUNK BEND

Stand erect with the feet a shoulder-width apart.

Count 1. Bend the trunk forward and down, flexing the knees. Stretch gently in an attempt to touch the fingers to the toes or floor.

Count 2. Return to the starting position.

Do the exercise slowly, stretching and relaxing at intervals rather than in rhythm.

Red Level Program - 2 to 10 times

White Level Program - 10 times

Blue Level Program - 10 times

(6) TRUNK ROTATION

Stand erect with the feet a shoulder-width apart and the fingers interlocked behind the head.

Count 1. Rotate the trunk to the right, keeping the feet flat on the floor.

Count 2. Return to the starting position.

Count 3. Rotate the trunk to the left, keeping the feet flat on the floor.

Count 4. Return to the starting position.

Red Level Program - 1 to 4 times

White Level Program - 5 to 7 times

Blue Level Program - 8 to 10 times

(1) LEG RAISE AND BEND

Lie on the back with the legs extended, feet together, and arms at the sides.

Count 1. Extend and raise the left leg about 10 inches off the floor.

Count 2. Bend the knee and bring it toward the chest as far as possible, using abdominal, hip, and leg muscles. Then clasp the knee with both hands and pull it slowly toward the chest.

Count 3. Return to the Count 1 position.

Count 4. Return to the starting position.

Counts 5, 6, 7 and 8. Repeat with right leg.

Red Level Program - 1 to 4 times, each leg

White Level Program - 5 to 8 times, each leg

Blue Level Program - 9 to 12 times, each leg

(2) PUSHUPS

(a) KNEE PUSHUP

Lie on the floor, face down, with the legs together, knees bent, feet raised off the floor, hands on the floor under the shoulders, and palms down.

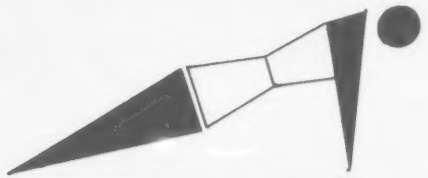
Count 1. Push the upper body off the floor until the arms are fully extended and the body forms a straight line from head to knees.

Count 2. Return to the starting position.

Red Level Program - 3 to 10 times

(b) REGULAR PUSHUP

Starting Position: Body off floor, arms fully extended so that body and legs form a straight line from head to heels.



Count 1. Lower body, touch chin only to floor.

Count 2. Push up, return to starting position.

White Level Program - 2 to 8 times

Blue Level Program - 9+ times

(3) SIDE LEG RAISES

Lie on the right side of the body with the left hand flat on the floor at chest level and the head resting on the right arm.

Count 1. Lift the left leg sidewards off the floor at approximately a 45-degree angle.

Count 2. Return to the starting position. Do the desired number of repetitions with the left leg and then turn over, lie on the left side, and exercise the right leg.

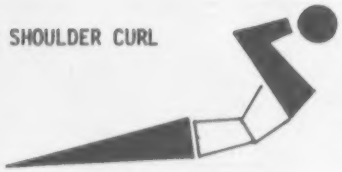
Red Level Program - 2 to 6 times

White Level Program - 7 to 10 times

Blue Level Program - 11 to 15 times

(4) SITUPS

(a) HEAD AND SHOULDER CURL



Lie on the back with the legs straight and the feet together, hands clasped behind the neck and held that way throughout the exercise.

Count 1. Tighten the abdominal muscles and lift the head and shoulders so that the shoulders are about 10 inches or 45 degrees off the floor. The head should lead in a "curling" motion, the chin tucked to the chest and the back rounded, not arched. Hold this position for 2 to 4 seconds.

Count 2. Return slowly to the starting position by "uncurling," keeping the abdominal muscles tight until the shoulders and the head rest on the floor.

Relax.

Red Level Program - 2 to 5 times

(b) BENT-KNEE SITUP

Lie on the back with the legs bent at the knees so that the feet are together and flat on the floor, the hands clasped behind the neck and held that way throughout the exercise.

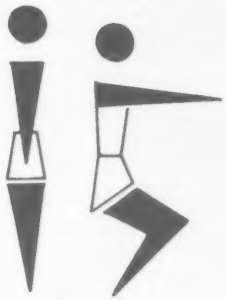
Count 1. Tighten the abdominal muscles and sit up so that the back is approximately perpendicular to the floor. The head should lead in a "curling" motion, the chin tucked to the chest and the back rounded, not arched.

Count 2. "Uncurl" back to the starting position, keeping the abdominal muscles tight until the shoulders and the head rest on the floor.

Relax.

White Level Program - 2 to 10 times

Blue Level Program - 11 to 25 times



(5) HALF-KNEE BENDS

Stand erect with the feet a shoulder-width apart and the hands on the hips.

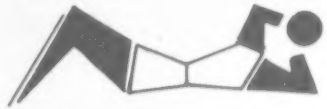
Count 1. Bend the knees halfway while extending the arms forward, palms down. Keep the heels on the floor.

Count 2. Return to the starting position.

Red Level Program - 2 to 5 times

White Level Program - 6 to 9 times

Blue Level Program - 10 to 15 times



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(6) WALL PRESS

Stand erect with the back against the wall and the heels about 3 inches away from it.
Count 1. Pull in the abdominal muscles and press the small of the back tight against the wall. Hold for 4 seconds.
Count 2. Relax and return to the starting position. Keep the entire back in contact with the wall on Count 1, without tilting the head backward.
Red Level Program - 2 to 4 times
White Level Program - 5 times
Blue Level Program - 5 times

(7) DIVER'S STANCE

Stand erect with the feet slightly apart and the arms at the sides. Rise on the toes and bring the arms upward and forward so that they extend parallel to the floor, palms down. When this position is attained, close the eyes and hold the balance for 10 seconds. The head should be straight and the body should be held firmly throughout.
Red Level Program - Hold 5 seconds
White Level Program - Hold 10 seconds
Blue Level Program - Hold 15 seconds

(8) STUDENTS ARE NOW READY TO BEGIN THEIR PROGRAM OF AEROBIC CONDITIONING.

RED LEVEL PROGRAM	WHITE LEVEL PROGRAM	BLUE LEVEL PROGRAM
WEEK 1 Walk at a brisk pace for 10 minutes, or for a shorter time if you become uncomfortably tired. Then walk slowly or rest three minutes. Walk again briskly for 10 minutes or until you become uncomfortably tired, or reach your maximal heart rate.	*WEEK 1* Jog 30 seconds (75 yards/67.5 meters) - Walk one minute (95 yards/85.5 meters). Repeat nine times.	*WEEK 1* Warm up with a one-minute jog and a one-minute walk. Jog three minutes (450 yards/405 meters) - Walk one minute (100 yards/90 meters). Repeat three times.
WEEK 2 Walk at a brisk pace for 15 minutes, or for a shorter time if you become uncomfortably tired. Then walk slowly for three minutes.	*WEEK 2* Jog 40 seconds (100 yards/90 meters) - Walk one minute (100 yards/90 meters). Repeat eight times.	*WEEK 2* Warm up with a one-minute jog and a one-minute walk. Jog four minutes (600 yards/540 meters) - Walk two minutes (200 yards/180 meters). Repeat two times.
WEEK 3 Jog 10 seconds (25 yards/22.5 meters) - Walk one minute (100 yards/90 meters). Repeat twelve times.	*WEEK 3* Jog one minute (150 yards/135 meters) - Walk one minute (100 yards/90 meters). Repeat six times.	*WEEK 3* Warm up with a one-minute jog and a one-minute walk. Jog five minutes (750 yards/675 meters) - Walk two minutes (200 yards/180 meters). Repeat two times.

WEEK 4

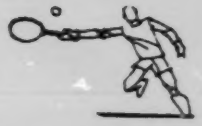
Jog 20 seconds (50 yards/45 meters) - Walk one minute (100 yards/90 meters). Repeat twelve times.

WEEK 4

Jog two minutes (300 yards/270 meters) - Walk one minute (100 yards/90 meters). Repeat four times.

WEEK 4

Warm up with a one-minute jog and a one-minute walk. Jog seven minutes (1050 yards/945 meters) - Walk two minutes (200 yards/180 meters). Repeat two times.



BLUE LEVEL PROGRAM

AFTER WEEK 10

Once the students have accomplished the goals of the first 10 weeks, they should level off at this plateau for 4 weeks in order to fulfill the last part of the definition of fitness, "week in and week out without excessive fatigue or injury." After an additional month of successful jogging, they may wish to better their time or increase their distance. Encourage them to increase *distance* rather than speed. A rule of thumb is to increase distance by not more than 10 percent, or a mile a week. If they succeed in increasing their distance, urge them to stay at the new level for at least 2 to 4 weeks before attempting to increase their distance again. Whatever the level of achievement, however, each running/jogging session should begin with an easy 440 for warmup and an easy 440 for cool-down.

WEEK 5

Jog three minutes (400 yards/360 meters) - Walk two minutes (200 yards/180 meters) - Jog ten minutes (1500 yards/1350 meters) - Walk two minutes (200 yards/180 meters) - Jog three minutes (400 yards/360 meters).

WEEK 6

Jog three minutes (400 yards/360 meters) - Walk two minutes (200 yards/180 meters) - Jog one mile (1760 yards/1584 meters) - Walk two minutes (200 yards/180 meters) - Jog three minutes (400 yards/360 meters).

WEEK 7

Jog three minutes (400 yards/360 meters) - Walk two minutes (200 yards/180 meters) - Jog 1 1/4 miles (2000 yards/1800 meters) - Walk two minutes (200 yards/180 meters) - Jog three minutes (400 yards/360 meters).

WEEK 8

Jog three minutes (400 yards/360 meters) - Walk two minutes (200 yards/180 meters) - Jog 1 1/2 miles (2640 yards/2376 meters) - Walk two minutes (200 yards/ 180 meters) - Jog three minutes (400 yards/360 meters).

WEEK 9

Jog three minutes (400 yards/360 meters) - Walk two minutes (200 yards/180 meters) - Jog 1 3/4 miles (3080 yards/2772 meters) - Walk two minutes (200 yards/180 meters) - Jog three minutes (400 yards/360 meters).

WEEK 10

Jog three minutes (400 yards/360 meters) - Walk two minutes (200 yards/180 meters) - Jog two miles (3520 yards/3168 meters) - Walk two minutes (200 yards/180 meters) - Jog three minutes (400 yards/360 meters).

AEROBIC RHYTHMS

Creative Fitness/Aerobic Rhythms$_{tm}$ is a "fun" way to exercise incorporating sound principles of exercise physiology to achieve aerobic fitness. Focusing primarily upon the skeletal and cardiac musculature, Creative Fitness/Aerobic Rhythms$_{tm}$ requires a minimum of special equipment. A recordplayer or taperecorder is necessary to play the music that provides the tempo and background for the exercises. The exercises themselves can be performed in most environments — in a gymnasium, in a classroom, on a stage, in a hallway, or (weather permitting) on a playground or a school lawn. Students need no special clothing other than a good support "sneaker" (all-purpose gym sneaker) that will slide easily during dance sequences. Although gym clothes are desirable, students can perform the exercises in comfortable, loose, "street" clothing.

Students should participate in aerobic rhythms activities for at least 20 minutes per session, three times each week; although two sessions/week will develop, improve, or maintain a good state of fitness and health. The rate, intensity, and duration of the activities should be adjusted to meet the individual abilities/needs of the students, with specific prescriptions/proscriptions defined when necessary for handicapped students or individuals with specific learning disabilities. Aerobic rhythms can thus provide all students with an opportunity to participate in a vigorous program of aerobic exercise while at the same time addressing individual differences in levels of physical fitness through the application of a specifically tailored exercise program.

GUIDELINES FOR PLANNING AEROBIC RHYTHMS EXERCISE ROUTINES

1. Plan only three or four basic exercises* per routine.** Exercises can be, and frequently are, repeated in the same routine.
2. Choose music with a 4/4 or 2/4 time.
3. Select music that fits the mood — warmups flowing smoothly/rhythmically to a slow beat with a gradual upbeat (crescendo) inherent within the workout; peak work periods peppy (allegro) with a definite beat; cool-downs slow and soft, gradually cooling down to relaxation and tension control.
4. Tape the music — with 15 to 20 seconds between routines for monitoring pulse and providing time for specific instructions.
5. Organize or structure routines for a given position of the body (sitting, standing, supine) with a minimum of change in position or routine.
6. Make the routines simple so that time spent on teaching steps is kept to a minimum and time spent on continuous movement is maximized. Basic exercises should be described, then demonstrated, and finally performed slowly by the participants before starting the choreographed routines.
7. General rules regarding the safety/health of the students should be adhered to at all times.

*A *basic exercise* is a rhythmic movement which makes use of one or a group of skeletal muscles.
**A *routine* is a sequentially arranged set of basic exercises choreographed to the music of a song.

Additional suggestions that may be of benefit include the following:

- To add more variety, routines can be choreographed using weights, wands, frisbies, tin cans, balls, bells, indian clubs, tubing, ribbons, paddles with ribbons, jump ropes, etc.
- In addition, routines can be set to various types of mood music — disco, rock, jazz, broadway tunes, movie themes, classical, popular, country & western, etc. Waltzes, cha cha cha's, the charleston, rhumbas, polkas, marches, and folkdancing can also be used to stimulate and/or maintain interest.
- Encourage the students to do their own choreography, perhaps using ethnic dances and music.
- Demonstrations can be performed at PTA meetings, assemblies, and other school functions.
- For motivational purposes, a chart could be designed to record weight, specific body measurements, resting heart rates, exercise heart rates, and recovery rates.
- Make the activities pleasurable by using a variety of musical selections, by working from simple to more complex and vigorous routines, by maintaining a sense of humor and always a smile, by discouraging competition, and by encouraging everyone -- no one flunks at exercise!
- Special remedial routines can be designed for students with handicapping conditions or with specific physical weaknesses. This can be done by integrating specific exercise(s) into a routine.
- Keep the workout FUN!

PROGRAM OVERVIEW

Basic Learning Objective

Having participated in a program such as the one detailed on the following pages, the students will (1) exhibit increased cardiovascular fitness through improved physical performance and (2) be able to demonstrate an understanding of the fundamentals of aerobic rhythms, including not only specific concepts and knowledges associated with the physiological aspects of program participation but also basic competencies in the design and application of aerobic exercise to music.

Program Description	*Program Outline*	*Resources*
THE WARMUP Creative fitness routines will include traditional calisthenics as well as stretching and range-of-motion	Exercises I, II, and III — The Warmup (pp. 46 - 54).	*The Official YMCA Physical Fitness Handbook*, by Clayton R. Meyers. (New York: Popular Library, 1977).

Program Description	*Program Outline*	*Resources*
exercises designed to develop and/or improve the strength and endurance of the major skeletal muscle groups. Choreographed to music, the exercise routines will also increase the flexibility of the major joints and tendons of the body while providing an enjoyable experience for the participants. Ultimately, the students will *feel* the physiological benefits resulting from a sound warmup, as they come to understand the functions of the warmup in preparing the body for optimal and efficient performance in physical activity.		*How to Keep Slender and Fit After Thirty*, by Bonnie Prudden. (New York: Pocket Books, Inc., 1972). *The Y's Way to Physical Fitness: A Guidebook for Instructors*, ed. by Clayton R. Meyers, Lawrence A. Golding, and Wayne E. Sinning. 1979. (Available through the National Board of YMCA's, 291 Broadway, New York, NY 10007).
PEAK WORK PERIOD Aerobic rhythms is a form of exercise that combines dance steps, calisthenics, and rhythmic movements at various levels of intensity with a variety of musical scores and moods to challenge or stimulate the cardiorespiratory system. Properly prescribed and implemented, the routines will produce measurable improvements in physical fitness and cardiovascular health because they enable large numbers of students to participate at individually prescribed paces, in a group atmosphere, for the entire class period.	Exercises IV, V, and VI — Aerobic Rhythms (pp. 54 - 61).	
THE COOL-DOWN Through aerobic rhythms designed to reduce heart rate, blood pressure, and metabolism to pre-exercise or "resting" levels, the students will gain an understanding of the basic	Exercise VII — The Cool-Down (p. 61).	*Yoga 28 Day Exercise Plan*, by Richard Hittleman. (Des Plaines, IL: Bantam Books, Inc., 1973).

principles of post-exercise recovery. Quiet, relaxing music will be used to create an atmosphere or mood, and gradually slowed, rhythmical, nontensive movements choreographed to the music will bring about a gradual relaxation of the skeletal musculature and a release of muscle tension.		"An Exercise Manual," Chapter 4 of *Clinical Treatment of Back and Neck Pain*, by Hans Kraus. (New York: McGraw-Hill Book Company, 1970).
	Exercise VIII — Tension Control and Relaxation (pp. 61-62).	*How to Teach Scientific Relaxation*, by Edmund Jacobson.

EXERCISE I

THE WARMUP
Upper Body

The warmup is done with the students standing in scattered lines or in a semicircle facing the teacher as in a mirror image.

Suggested music: *Star Wars Theme/Cantina Band* by John Williams (45 MN 604 MECO)

Introduction: Wait count of 4

4 Shoulder Shrugs	Feet apart, shoulder-width, bring both shoulders up in the direction of the ears and then let go.
12 Rope Climbs	Feet apart, shoulder-width, reach overhead alternating arms R, L, as if climbing a rope.
8 Back Arm Circles	Feet apart, slightly outside the shoulders, circle both arms simultaneously back, lifting the heels slightly off the floor.
8 Forward Arm Circles	Feet apart, slightly outside the shoulders, circle both arms simultaneously forward, lifting the heels slightly off the floor.
4 Forward Swimmer/ Crawl Strokes	Feet apart, shoulder-width, bend slightly forward from the waist, alternately rotate the arms in large circles forward from the shoulder joints, as in the crawl stroke in swimming. Slowly, R, L, R, L.
8 Forward Swimmer/ Crawl Strokes	Same as above, but faster pace, R, L, R, L, R, L, R, L.

4 Reverse Swimmer/ Crawl Strokes	Feet apart, shoulder-width, stand erect and alternately rotate arms in large circles back from the shoulder joints, as in the back crawl stroke in swimming. Slowly, R, L, R, L.
8 Reverse Swimmer/ Crawl Strokes	Same as above, but faster pace, R, L, R, L, R, L, R, L.
4 Shoulder Shrugs	As explained on the preceding page.
6 Chicken Wings	Feet apart, shoulder-width, make loose fists, bend arms at elbows in a chicken wing position, and circle wings in a reverse direction at shoulder level.
8 Arm Scissors	Feet apart, shoulder-width or just outside the shoulders, swing both arms out from the chicken wing position, shoulder level, then cross the arms in front of the body at shoulder level as far as possible.
9 Rotators	Feet apart, just outside the shoulders, arms stretched out to the sides at shoulder level; swing the right arm at shoulder level over the left shoulder and return to the right side at shoulder level; swing the left arm at shoulder level over the right shoulder and return to the left side at shoulder level, R, L, R, L, R, L, R, L, R.
8 Windmills	Feet apart, shoulder-width, knees slightly bent, arms stretched out to the sides at shoulder level, swinging the right arm up and dropping the left arm down slightly, bending the upper body in a lateral bend to the left side — continue swinging the right arm in a direction outside the right knee with the left arm swinging slightly further behind the body in the direction of the right side; return in reverse direction to complete the windmill, bending laterally to the right side, using the arms as a windmill, L, R, L, R, L, R, L, R. Finish with hands on waist.
4 Trunk Rotators	With the hands on the waist and feet apart, just outside the shoulder width, bending from the waist with the knees slightly bent, drop the chin to the chest, rotate the trunk down to the right side across the front of the body (head down) and to the left side, and stand erect. Reversing the direction, drop the chin to the chest, rotate the trunk down to the left side across the front of the body (head down) and to the right side, and stand erect.
4 Trunk Rotators	Same as above, but with the hands behind the neck. (Rotate from right to left, and left to right for a total of 8 Trunk Rotators).
4 Breast Strokes	Feet apart at shoulder-width, hands together in front of the chest, and elbows held at shoulder level, bend the knees and push the arms outward in front and to the sides

at shoulder level; then return the hands together in front of the chest and stand erect, as in the breast stroke in swimming.

4 Scoops	Feet apart, slightly wider than shoulder-width, extend the arms out to the sides at shoulder level, bend the knees and bring the right arm down to knee or shoe level, across the body, and overhead — as if scooping a bucket of sand; then, having completed a full circle with the right arm, return the arm to the side, stretched out at shoulder level, and stand erect. Bend the knees and bring the left arm down to knee or shoe level, across the body and overhead, as if scooping a bucket of sand; then, having completed a full circle with the left arm, return the arm to the side, stretched out at shoulder level, and stand erect. R, L, R, L.
4 Alternate Toe-Touchers	Feet apart, slightly outside shoulder-width, stretch both arms overhead; bring both hands to the waist; touch the right hand to the left toe, bending from the waist in a slight twist; return the hands to the waist; stretch both arms overhead; bring both hands to the waist; touch the left hand to the right toe, bending from the waist in a slight twist; then return the hands to the waist, L, R, L, R.
8 Knee Lifts	(Can be done while turning in the student's own circle.) Bring the right knee up as high as possible in a march step, pointing the toe, and return the right foot to the floor. Bring the left knee up as high as possible in a march step, pointing the toe, and return the left foot to the floor (can also be done with a skip) — R, L, R, L, R, L, R, L.
4 Floor-Touches Center	Feet apart at shoulder-width, stretch both arms overhead, bring the hands to the waist; then bend the knees slightly while bringing the chin to the chest and rounding down (bending from the waist), touch the fingers to the floor between the feet, and return to standing position with both hands on the waist.
2 Wood Choppers	Feet apart, just slightly outside shoulder-width, swing both hands and arms overhead as if holding an ax in the hands; bend from the waist; round the chin to the chest; swing the arms out and down, passing through the legs and reaching behind, the knees slightly bent; then round back up, bringing the arms back overhead as if to swing the ax up high, arching the back slightly; and repeat.
Yoga Hang	Feet slightly apart, swing the arms overhead; then, as the arms swing forward and down, tuck the chin to the chest and, with knees slightly bent, bend from the waist and hang the head, arms, and hands down toward or on the floor, looking back between the legs until the music ends.

Have the students monitor their pulse for 15 seconds and,
if the training stimulus has not been exceeded, continue with Exercise II.

EXERCISE II

THE WARMUP
Lower Body, Including Situps

This exercise is also done with the students sitting in scattered lines or in a semicircle facing the teacher, as in a mirror image.

Suggested music: *Knock Three Times*, by Dawn (45 BELL 938)

4 Neck Rotations

Sitting with the legs straight out front, the feet turned out in order to be able to let go (relax), and the hands palms down on the floor under the shoulders, bend slightly from the waist, chin on chest, and rotate the head over to the right shoulder, back to center, over to the left shoulder, and back to center, R, L, R, L.

6 Situps

Starting from a sitting position, with the chin on the chest and the hands stretched out to bent knees, round the back down to the floor until the back and head are on the floor while the hands slide from the knees, down the thighs, to the floor.

Choose one or a combination of the following situp progressions (6 times), with knees bent:

a. Arms at the sides on the floor, round the chin to the chest, and return the head to the floor.

b. Arms and hands sliding up the thighs to the knees, round the chin to the chest, bringing the head and upper back off the floor; then round the back and head back down to the floor, knees bent.

c. Arms and hands stretched out overhead on the floor, upper arms alongside the ears, swing the arms up and beyond the knees, round the chin to the chest, bring the head and upper and lower back off the floor to a sitting position, then round back down to the floor. Be sure to round the spine up and round the spine back down, with the knees bent, until the head is on the floor.

d. Arms crossed on the chest and hands clasped to the upper arms, sit up by rounding the head up and dropping the chin to the chest to a sitting position; then round back down to the floor, with the spine rounded and the knees bent, until the head is on the floor.

e. Hands held behind the neck, round up to a sitting position, bringing the head up, the chin to the chest, and rounding the spine up; then round the spine back

down until the back and head are on the floor, knees bent.

2 Hip Raises	Sitting with the legs straight out front, the feet together, and the hands palms down under the shoulders, arch the back upward, raising the hips as far as possible without arching the back, chin on chest. Return by lowering the hips to the sitting position.
2 Hip Raises with Head Extended Back	Start as above; then, arching the back upward, drop the head back with the chin in the direction of the ceiling. Lower the hips, bringing the head and chin back towards the chest.
6 Situps	Remember — always *bent knee!* Choose one or a combination of a, b, c, d, or e, as described on the preceding page and above. When doing d, variations like the following might add some spice to the workout: swinging up to the left foot with the right hand and swinging up to the right foot with the left hand, hitting the floor with the palms of the hands before coming up and again after sitting up, snapping the fingers, etc.
2 Hip Raises	As explained above.
2 Hip Raises with Head Extended Back	As explained above.
6 Situps	As before — *with bent knees!* Choose one or a combination of a, b, c, d, or e, as described on p. 49. Prepare for flutter kicks after the last situp.
16 Flutter Kicks	Lie on the back, supporting the lower back area by placing the hands palms down under the buttocks (the small of the back should touch the floor throughout the exercise). Lift the chin off the chest. Extend the lower limbs about a foot/30 cm. from the floor and alternately lower and raise them within that distance, with the heels flexed.
8 Flutter Kicks over the Hips	As explained above, but with the limbs raised over the hips. The legs can be slightly bent or straight.
3 Back Presses	With the knees bent, press the small of the back into the floor, and then let go (relax). The arms should be down at the sides with the palms up.

Have the students monitor their pulse for 15 seconds and,
if the training stimulus has not been exceeded, continue with Exercise III.

EXERCISE III

THE WARMUP
Lower Body, Including Pushups

This exercise is also done with the students organized into scattered lines or in a semicircle facing the teacher, as in a mirror image. Start in a supine position, knees apart, arms down at the sides of the body, palms up.

Suggested music: *One of These Nights*, by the Eagles (Elektra 45077)

4 Back Presses	Lie on back with the knees bent; press the waistline and the small of the back into the floor; then release the back (relax, let go).
4 Hamstring Stretches	Lie on back, both knees flexed, arms at the sides, palms up. Bring the right knee to the chest; raise that leg straight up in the air over the hip; then lower the leg (keeping it as straight as possible) to the floor; bend the knee back to the starting position. Bring the left knee to the chest; raise that leg straight up in the air over the hip; then lower the leg to the floor (keeping it as straight as possible); and bent the knee back to the starting position, R, L, R, L.
8 Eagles	Lie on back, legs extended out in front and together, chin on chest, arms outstretched at shoulder level, palms pressed to the floor. Raise the right leg straight up over the hip and across the body to the left side, and touch the floor with the toe as near to the left hand as possible; bring the leg back over the hip and lower it to the floor to the starting position. Raise the left leg straight up over the hip and across the body to the right side, and touch the floor with the toe as near to the right hand as possible; then bring the leg back over the hip and lower it to the floor to the starting position, R, L, R, L, R, L, R, L.
2 Knees to Chest	Knees bent, bring both knees up toward the chest; then drop both feet (dead weight) back to the floor.
2 One-Knee Situps	Bring the right knee to the chest, holding the knee with both hands (the left knee remains bent), and pull the upper body up, rounding the spine as in a situp. Then round the spine back down to the floor with the arms out in front of the body at shoulder level. Bring the left knee to the chest, holding the knee with both hands (the right knee remains bent), and pull the upper body up, rounding the spine as in a situp.
12 Pushups	Assume an "all-fours" position (arms straight with the hands on the floor under the

shoulders, knees bent, and hips above the knees, like a four-legged animal) and do one of the following: 12 a's, 12 b's, 12 c's, or *preferably*, 4 a's, 6 b's, and 2 c's.

a. Beginner Pushups
Rock backward, buttocks to heels, keeping the hands on the floor and the arms stretched at an angle from the shoulders; then rock forward, supporting the body weight on the knees and between the shoulders and hands until the chin and chest are down close to the floor (keep the back straight); then push back up and rock back, buttocks to heels.

b. Intermediate Pushups or Knee Pushups
With the back straight, let the chest and chin down close to the floor, bending the elbows; then push back up until the arms are fully extended, knees bent and feet raised slightly off the floor.

c. Advanced Pushups
Hands placed below the shoulders with the arms fully extended and the back straight, support the body weight on the toes with the legs straight. Lower the body by bending the arms until the chest is approximately one inch from the floor. Return to the original position by extending the arms to complete one repetition.

NOTE: All three forms (a, b, and c) can be modified even further for the beginner by letting the body down only a few inches, gradually lowering more each time, and always returning to the original position by extending the arms to complete one repetition — until the student can progress to advanced pushups.

1 Sitback	With the arms outstretched in front of the body (palms down on the floor), sit back, buttocks on heels, to the count of 16, ending back in the all-four's position.
1 Mad Cat	Starting on the hands and knees in the all-four's position, drop the head (chin to chest) and round the back like an angry cat.
1 Horse	From the cat position, let the back sag like a tired, swayback horse and look up.
1 Mad Cat	As explained above.
1 Horse	As explained above.
6 Back Leg Swings	Start in the all-four's position; bring the left leg back, crossing behind the right and over the top of the right calf, and set the toe of the foot on the floor;

	then, keeping the left leg straight, swing it around and place the foot on the floor in front or near the left hand. Repeat, for a total of 6 back left leg swings.
1 1/2 Threading of the Needle	In the all-four's position, swing the left hand with the arm extended overhead and look up in that direction; bring the left hand down through and under the right arm, trying to put the shoulder and the left ear on the floor; then swing the arm back out to the side and return to the floor in the all-four's position.
6 Back Leg Swings	As explained above, this time using the right leg.
1 1/2 Threading of the Needle	As explained above, this time using the right hand.
4 Beginner Pushups	As explained on the preceding page.
6 Intermediate Pushups	As explained on the preceding page.
2 Advanced Pushups	As explained on the preceding page.
1 Sitback	As explained on the preceding page.
1 Stretch Back Out	Start on hands and knees with insteps flat on the floor, letting the hips down and arching the back until the fronts of the thighs touch the floor; look up, hold, and then return to the all-four's position.
4 Knee-to-Nose Stretches*	Start in the all-four's position; bring the right knee (rounding the spine) as close to the nose as possible. Then stretch the right leg in, back, and up, and look up.
4 Fire Hydrants*	Start in the all-four's position; bend the right leg, raise it to hip level, extend it out to the right at hip level, then bend it back in raised position at hip level, and return the knee to the all-four's position.
4 Knee-to-Nose Stretches*	As explained above, this time using the left knee.
4 Fire Hydrants*	As explained above, this time using the left leg.

* 4 Beginner Pushups, 6 Intermediate Pushups, and 2 Advanced Pushups — or Sprinters (explained on next page)— can be substituted for the 4 Knee-to-Nose Stretches, 4 Fire Hydrants, 4 Knee-to-Nose Stretches, and 4 Fire Hydrants described above.

1 Sitback	As explained on p. 52, to the count of 16.
1 Turtle	Buttocks on heels, head on the floor in front of the knees in the sitback position, bring the arms down to the sides with palms up at the feet to the end of the music.
Sprinters	Starting from the all-four's position, stand on one foot with that knee bent, extend the opposite leg out behind, and bounce up and down easy, raising the buttocks. Repeat with the opposite leg forward; then alternate legs quickly, one leg back and the other forward, bouncing up and down with each change.

Have the students monitor their pulse for 15 seconds and,
if the training stimulus has not been exceeded, continue with Exercise IV.

EXERCISE IV

AEROBIC EXERCISE

To determine at what level each student can participate in the aerobic phase of the physical fitness class:

- Have the students walk for 3 minutes to a tune such as *S.W.A.T.*, by Ray Coniff, and then monitor pulse rates.
- Using another tune (such as Herb Alpert's *So What's New*), have the students who reached their training stimulus at the walk level of intensity continue to walk, and those who have not yet reached their training stimulus walk *briskly* for another 3 minutes; then monitor pulse rates.
- Continue with a third tune (such as *Gonna Fly Now*, Theme from *Rocky*, original motion picture score) and have the students who reached their training stimulus at the walk level or at the brisk walk level continue at this level of intensity, and those who have not yet reached their training stimulus *jog* for another 3 minutes; then monitor pulse rates.
- Continue with a fourth tune (such as *Whipped Cream*, by Herb Alpert) and have the students who reached their training stimulus at the jog level of intensity continue to jog, walk briskly, or simply walk in order to maintain their training stimulus, and those who have not yet reached their training stimulus *run* for another 3 minutes; then monitor pulse rates.
- Continue with another tune (such as *Heaven on the Seventh Floor*, by Paul Nicholas) and lead the students through walking, jogging, running, jumping in place, skipping, jumping jacks, and simple dance movements. Monitor pulse rates to determine at what level these simple exercises can be done.

Exercises to prevent shin splints may be helpful here. These can be performed during the first tune as well as walking on the toes, walking with the toes pointed in and then out, walking a few steps on the heels, etc.

EXERCISE V

AEROBIC RHYTHMS

This exercise begins with the students standing in scattered lines. The teacher's back is to the students for ease in following the steps.

Suggested music: *Funk* by Harold Wheeler-Solomon Smith (MECO MN 604)

Introduction: Wait for first 2 counts.

6 Toe Rock Changes	Stand with the left toe touching the floor and the weight on the right foot; on the third count of the music, rock down on the left foot with the weight on the left and the right toe touching the floor. Then rock down on the right foot with the weight on the right and the left toe touching the floor. L, R, L, R, L, R.
3 March Forward/Pivot Steps	Left foot, right foot; then pivot a quarter turn on the left foot forward and step on the right foot. Left foot, right foot; then pivot a half turn on the right foot forward and step on the right foot. Left foot, right foot; then pivot a quarter turn on the left foot forward (completing a square), and step on the right foot.
8 Marches Forward	L, R, L, R, L, R, L, R.
Back, Side, Step, Lift, Step, Kick, Step, Kick, Step, Kick, Step, Kick, Step, Kick, Step, Kick	With the weight on the right foot, bring the left foot *back*, crossing behind the right foot; step out to the *side* with the right foot; *step* on the left foot, facing the right side of the gym; *lift* the right knee as high as possible, pointing the toes down and rounding the back slightly; *step* on the right foot, *kick* high with the left; then, facing the rear of the gym, *step* on the right foot, *kick* high with the left; *step* on the left foot, *kick* high with the right; *step* on the right foot, *kick* high with the left; *step* on the left foot, *kick* high with the right; *step* on the right foot; and *kick* high with the left.
	NOTE: This exercise can be performed at jog or run levels of intensity by doing the step/kicks with a bounce, a hop, or a skip, and swinging the leg during the kick.
Back, Side, Step, Lift, Step, Kick, Step, Kick, Step, Kick, Step, Kick, Step, Kick, Step, Kick	With the weight on the left foot, bring the right foot *back*, crossing behind the left foot; step out to the *side* with the left foot; *step* on the right foot, facing the left side of the gym; *lift* the right knee as high as possible, pointing the toes down and rounding the back slightly; *step* on the left foot, *kick* high with the right; then, facing the front of the gym, *step* on the left foot, *kick* high with the right; *step* on the right foot, *kick* high with the left; *step* on the left foot,

	kick high with the right; *step* on the right foot, *kick* high with the left; *step* on the left foot, and *kick* high with the right.
	NOTE: As noted before, the exercise can be performed at jog or run levels of intensity by doing the step/kicks with a bounce, a hop, or a skip, and swinging the leg during the kick.
2 March Forward/Pivot Steps	Left foot, right foot; then pivot a half turn on the left foot and step on the right foot. Left foot, right foot; then pivot a half turn on the left foot (completing the circle) and step on the right foot.
8 Marches Forward	L, R, L, R, L, R, L, R.
Scissor Jump—Double	Jump at an angle to the left side, with the left knee slightly bent; the right leg should be straight, with the left hand in salute and the right hand on the waist. Repeat. (NOTE: This activity can be done at low or high levels of intensity).
Scissor Jump—Double	Jump at an angle to the right side, with the right knee slightly bent; the left leg should be straight, with the right hand in salute and the left hand on the waist. Repeat. (NOTE: This activity can be done at low or high levels of intensity).
Scissor Jump—Hold	Jump at an angle to the left side, hold, and clap.
Scissor Jump—Hold	Jump at an angle to the right side, hold, and clap.
Scissor Jump—Double	To the left, as explained above.
Scissor Jump—Double	To the right, as explained above.
	NOTE: For low intensity exercise, use a light bounce or small jump; for higher levels, use a more vigorous bounce or a bigger jump.
Scissor Jump—Hold	To the left, as explained above.
Scissor Jump—Hold	To the right, as explained above.
Scissor Jump—Double	To the left, as explained above.
Scissor Jump—Double	To the right, as explained above.
Scissor Jump—Hold	To the left, as explained above.

Scissor Jump—Hold	To the right, as explained on the preceding page.
8 Straddle Jumps	While the left leg jumps forward, the right leg jumps backward with or without the arms swinging. If the arms are not swinging down at the sides forward and back, alternating the opposite arm forward with the opposite leg back, then keep the hands on the waist, L, R, L, R, L, R, L, R. NOTE: For low intensity exercise, keep the hands on the waist and do only 4 Straddle Jumps with a hold count of 1 between each jump: L-Hold, R-Hold, L-Hold, R-Hold.
4 Jumps	With the knees slightly flexed, jump back 4 jumps with 4 claps. NOTE: For low intensity exercise, just bounce 4 times in place by flexing and straightening the knees, with the 4 claps.
4 Quick Jump Togethers	Moving to the left, jump out on the left foot to the left side and step on it; bring the ball of the right foot alongside the left foot; repeat three times.
2 Country Hoedowns	Jump both feet apart to the floor facing the left wall of the gym; standing on the left foot, lift the right foot across the back of the left leg and touch the left hand to the right foot; repeat. NOTE: For low intensity exercise, use a light bounce or a small jump; for higher levels, use a more vigorous bounce or a bigger jump.
4 Quick Jump Togethers	As explained above, moving toward the rear wall of the gym.
2 Country Hoedowns	As explained above, facing the rear.
4 Quick Jump Togethers	As explained above, moving toward the opposite wall of the gym.
2 Country Hoedowns	As explained above, facing the opposite wall.
4 Quick Jump Togethers	As explained above, moving toward the front of the gym.
2 Country Hoedowns	As explained above, facing the front of the gym.
March Forward	L, R; then pivot on the left foot (until facing the rear of the gym).
March Forward	L, R; then pivot on the left foot (until facing the front of the gym).

8 Marches Forward	L, R, L, R, L, R, L, R.
1 Wind Up to Left	Step out to the *left* with the left foot pivoting, turning on the *right* foot pivoting (completing a full turn); then step *left* on the left foot, reach the hands out to the left side, and clap once, pausing with the right toe alongside the left foot.
4 Jogs or Walks Forward	To the left (R, L, R, L).
1 Wind Up to Right	Step out to the *right* with the right foot pivoting, turning on the *left* foot pivoting (completing a full turn); then step on the *right* foot, reach the hands out to the right side, and clap once, pausing with the left toe alongside the right foot.
4 Jogs or Walks Forward	To the right (L, R, L, R).
1 Wind Up to Left	As explained above.
4 Jogs or Walks Forward	To the left (R, L, R, L).
1 Wind Up to Right	As explained above.
4 Jogs or Walks Forward	To the right (L, R, L, R).
Jog or Walk 32 Steps	Start with the left foot and form a large circle (if the group is large and space is limited, use two or more concentric circles), with the walkers moving to the outer rim.
March Forward Into the Circle	Left foot, right foot; then pivot on the left foot (until facing the outside of the circle).
March Forward Out of the Circle	Left foot, right foot; then pivot on the left foot (until facing the center of the circle).
March Forward Into the Circle	As explained above.
4 Jumping Jacks with Hands on Hips	Jump the feet apart, then jump them back together. NOTE: For low intensity exercise, do only 2 Jumping Jacks at half time (i.e., jump the feet apart and pause, then jump the feet together and pause).

4 Jumping Jacks with Arms Swinging Overhead	Swing the arms overhead as the feet jump apart, then bring the arms down to the sides of the body as the feet jump back together. NOTE: For low intensity exercise, do only 2 Jumping Jacks at half time (i.e., swing the arms overhead as the feet jump apart, hold, and pause; then bring the arms down to the sides as the feet jump back together, hold, and pause).
8 Knee Lifts (turning in the student's own circle)	As explained on p. 48, turning in a left circle, lifting L, R, L, R, L, R, L, R.
16 Rope Skips	Jump on the left foot with a bounce while swinging the right leg back (knee slightly bent) and then swing forward, extending the leg. Jump on the right foot with a bounce while swinging the left leg back (knee slightly bent) and then swing forward, extending the leg. L, R, L, R, L, R, L, R — arms slightly bent at the elbow and hands down alongside the top of the thighs, circle the hands *back* at the wrists, as if jumping rope. L, R, L, R, L, R, L, R - arms slightly bent at the elbow and hands down alongside the top of the thighs, circle the hands *forward* at the wrists, as if jumping rope. NOTE: For low intensity activity, jump on the left foot, then on the right, without swinging the leg or arms and without a bounce.
32 Walks or Jogs	Moving in a circle to the left, start on the left foot for 12 walks or jogs; then reverse the direction, moving in a circle to the right for 12 walks or jogs. Walkers should stay on the outside of the circle, and joggers on the inside of the circle.
Marches in Line Formations According to the Number of Students in the Class	Each leader marches to the rear of his/her line like a robot, the activity repeated with new leaders until the music ends.

Have the students monitor their pulse for 15 seconds and,
if the training stimulus has not been exceeded, continue with Exercise VI.

EXERCISE VI

AEROBIC RHYTHMS

This exercise begins with the students standing in scattered lines in the front left quarter of the gym. The teacher's back is to the students so that they can follow the steps easily.

Suggested music: *Mame*, by Arthur Fiedler (in any of these albums by RCA: ARLI-0509, LSC-3201, and LSC-3249)

Introduction: Toe Rock Changes as described on p. 55, starting on the left foot and facing the right wall of the gym.

Sequence A

8 Forward Walks, Jogs, or Runs - to the right wall of the gym.

8 Forward Walks, Jogs, or Runs - to the back wall of the gym.

8 Forward Walks, Jogs, or Runs - to the left wall of the gym.

8 Forward Walks, Jogs, or Runs - to the front wall of the gym.

8 Knee Lifts — As explained on p. 48, turning in a circle to the left, L, R, L, R, L, R, L, R.

Repeat Sequence A

8 Jumping Jacks — As explained on p. 58.

Repeat Sequence A

8 Hoedowns — As explained on p. 57.

Repeat Sequence A

4 Dancer's Kicks — Start on the left leg, hands on hips, and touch the left toe down to the floor (with a bounce for jog level intensity); then lift the left knee high (with a bounce for jog level intensity), pointing the toes to the floor; touch the left toe back down to the floor (with a bounce for jog level intensity); then kick the right leg out in front as high as possible (with a bounce for jog level intensity).

4 Dancer's Kicks — Same as above, using the right leg.

Repeat Sequence A

131

132

8 Knee Lifts	As explained on p. 48, turning in a circle to the left. Slap the knees with the hands as they lift.
8 High-Step Kicks	Step on the left foot and kick low or high with the right leg (hands on waist), then step on the right foot and kick low or high with the left leg (hands on waist).
Walk, Jog, or Run	In organized scattered lines, continue to Walk, Jog, Run, or do low or high level Jumping Jacks to the end of the music.

Have the students monitor their pulse for 15 seconds and,
if the training stimulus has not been exceeded, continue with Exercise VII.

NOTE: Have the students move between each aerobic activity — walking, jogging, running, even if only done in place, in order to maintain the 65 to 85 percent of the maximal heart rate required for each individual student's cardiovascular training.

EXERCISE VII

COOL-DOWN

The cool-down is best performed with the students in an organized circle.

Suggested music: *Send in the Clowns*, by Ray Coniff (Columbia KC-34170)

Start the cool-down by walking with the shoulders up, then back, and then down; keep the rib cage up; breathe normally; walk in one direction, and then in the other. While walking, toe in, then toe out; take a few steps on the heels; and then walk on the toes with the arms stretched overhead. Include some stretching and flowing of the arms, simple walk-level dance steps, and yoga stretches and hangs. Move to the slow, rhythmic mood of the music, keeping in mind continuous slow movements to cool off for 3 to 5 minutes.

Have the students monitor their pulse for one
full minute and then go on to Exercise VIII.

EXERCISE VIII

TENSION CONTROL AND RELAXATION

This "exercise" is done lying on the back, with the knees flexed, the arms down along the body, and the palms up.

Suggested music: *Dolce*, by Henry Mancini or *Jenny's Theme*, by Ronnie Aldrich (London SP-44190)

Starting with the head and face and working down to the toes, tense and let go a muscle and include some of the Hans Kraus back-relaxing exercises listed below:

1. Lie on back, knees flexed; take a deep breath, and exhale; let one leg slowly slide out straight and let go, then return to the bent-knee position; repeat with the other leg.

2. Lie on back, knees flexed; let the head roll slowly to the left, then back to center, then to the right; repeat two or three times.

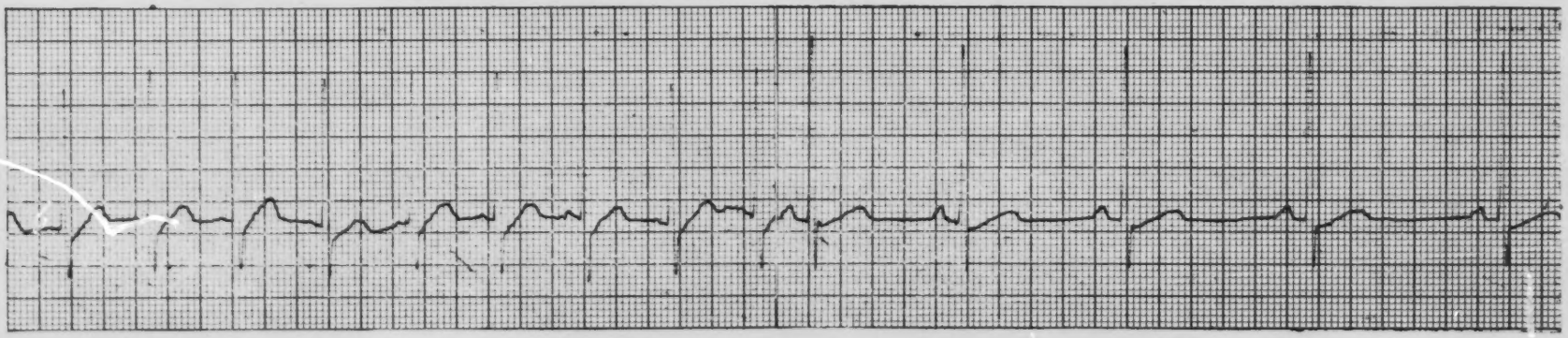
3. Lie on back, knees flexed; bring the right knee to the chest, slowly lower the foot to the floor, slide the leg out straight, let go (dead weight), and return to the bent-knee position; repeat with the left knee.

4. Lie on the left side in a fetal position, the head resting on an arm, knees bent. Without losing contact with the body or the floor, slide the right knee slowly up as close to the chest as is comfortable; slowly extend the leg until it is straight; then return to the fetal position. Repeat two or three times. Then lie on the right side and perform the activity as described above.

NOTE: When a muscle is jerked into extension, the muscle tends to "fight back" and shorten. When the muscle is slowly stretched and held, the muscle relaxes and lengthens. The relaxed, lengthened muscle is more efficient, is less prone to injury, and recovers sooner from stress.

Continue to tense the fists, then let go slowly (relax), raise the eyebrows and let go (relax), press the back (waistline) into the floor and let go (relax), flex the feet at the ankles and then let go (relax), wiggle the toes, etc., until the music ends (approximately 5 minutes).

The students should now monitor their pulse for one full minute.



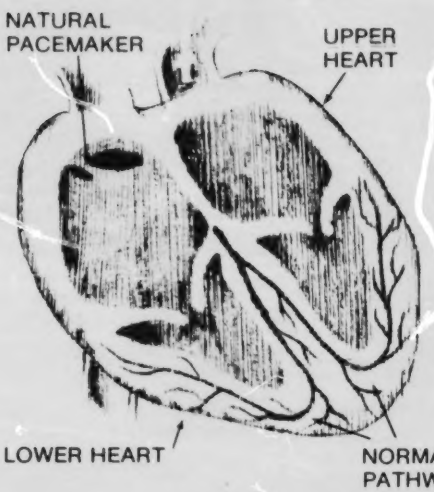
COGNITIVE LEARNING EXPERIENCES

The material in this section derives from the fundamental concepts as they apply to the goals identified on p. 1, but it is far from complete. The objectives and experiences are simply *examples* of the things that might be done in a physical education setting or as a cooperative venture by physical education, health, and/or biology teachers. The suggestions should be culled, modified, and supplemented to enhance the teacher's creative approach to enabling each student to become all he or she is capable of being.

GOAL: HAVING PARTICIPATED IN SUCH LEARNING EXPERIENCES AS THE FOLLOWING, THE STUDENTS SHOULD HAVE A BASIC UNDERSTANDING OF THE NATURE AND FUNCTION OF THE CARDIOVASCULAR SYSTEM.

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
The students will demonstrate a knowledge of the size, shape, position, location, and significance of the human heart.	• Make a fist with one hand, and explain that your heart is approximately as big as your fist. Ask the students to make fists and then, through questions, comparisons, discussion, etc., lead them to the conclusion that people's hearts — like their fists — differ in size and grow as they (the people) grow.	Page 2 of this publication
	• Have the students compare pictures or models of a human heart with Valentine hearts. How do they differ, and why? In what respects are they alike? What is St. Valentine's Day, and why is its symbol a heart?	Pictures or models of a human heart (Contact school health and/or science personnel, the school and/or community library, local health and/or medical centers, and college or university libraries and health, physical education, and/or science departments.) Valentines or student-made "hearts"
	REINFORCEMENT ACTIVITY	
	✓ In conjunction with their work in science, have the students use original drawings or pictures from appropriate texts to construct a poster or chart that shows how the human heart resembles the hearts of other animals in various stages of its development. For example, in its initial form, the heart is a simple tube that beats regularly and looks like the heart of a fish. As partitions begin to separate the atria from the ventricles and from each other, it resembles the heart of a frog; and when the atria have divided but separation between the ventricles is still incomplete, it compares with the heart of a snake or a turtle. As development proceeds, the human heart resembles.... What are some of the conclusions with regard to cardiovascular function that might be drawn from these comparisons?	General science or biology teachers Textbook illustrations of a human heart in various stages of development, and selected animal hearts (Contact the sources listed above.)

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	• Using Rescussi-Annie, anatomical models and/or charts, textbook illustrations, etc., help the students to identify the position of the heart in the human body.	**Rescussi-Annie** (Contact the local chapter of the American National Red Cross or the American Heart Association.) **Anatomical charts and/or models** (Contact school health and/or science personnel, local health and/or medical centers, and college or university health, physical education, and/or science departments.) **Textbook illustrations**
	• Ask the school nurse or a local physician to demonstrate *percussion* as a means of locating the heart.	**School nurse or local physician**
	• Have the students find the heart shadow in x-ray films.	**X-ray films** (Contact local physicians, hospitals, and health and/or medical centers.)
	• Locate and draw the outline of a male student's heart on the wall of his chest.	**Male student and a piece of chalk, pastel crayon, or magic marker**
	REINFORCEMENT ACTIVITY: ✓ In conjunction with their work in English, have the students explain the meaning of such words and phrases as the following, relating them to our knowledge of and attitude toward the human heart, and using them in sentences whenever appropriate: *The heart of the matter* — *Hearts of celery* *A heart-to-heart talk* — *Have a heart!* *To your heart's content* — *Heartthrob* *To set your heart on* — *Heave ho, me hearties!* *To learn by heart* — *A hearty meal* Encourage the students to identify and explain other uses of the word *heart*.	
The students will demonstrate an awareness of the structure of the human heart.	• Have the students examine textbook illustrations or plastic models as you describe the structure of the human heart.	**Textbook illustrations and/or plastic models of the human heart**
	• Develop an unlabeled wallchart diagram of the heart and a set	**A large, unlabeled diagram of the**



OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	of labels printed in appropriately large letters on cards or pieces of construction paper that can be pinned or taped to various parts of the diagram. Mix the labels well and place them face down on a desk or table a few feet from the diagram. One by one, have the students take a label from the pile, identify the part of the heart and its function, and pin or tape the label to the correct spot on the diagram.	human heart and a set of labels printed on cards or pieces of construction paper Pins or tape
	• Distribute copies of an unlabeled diagram of the human heart and have the students label the parts.	Multiple copies of an unlabeled diagram of the human heart — at least one per student
	REINFORCEMENT ACTIVITY:	
	✓ Print or write the labels for the various parts of the human heart (see diagram on p. 2) on pieces of construction paper, cut them into syllables, and put the syllable pieces into a bag. Develop enough sets to enable several groups of students to work with the same type of material. Then divide the class into groups and give each group a bag of syllables. Have the students pour the pieces onto a flat surface, mix them up, and draw from them to reconstruct the labels. Score one point for each correctly assembled word. More mature students might be asked to define the words as they assemble them. The student who completes — or completes *and* defines — the greatest number of labels wins the game.	Labels for the various parts of the human heart printed or written on construction paper; scissors; and paper bags
The students will demonstrate an understanding of the heart as a pump.	• Clasp your hands together in a container of water, forming a spout between the thumbs and forefingers. Then squeeze the palms together quickly (as children do when playing "whale"), sending a spurt of water into the air. Squeeze your palms in rhythm, explaining that the ventricles contract in much the same way to send the blood to various parts of the body. (Red food coloring adds a touch of realism, but is messy and may stain.)	A container of water large enough to accommodate clasped hands
	• Using an anatomical chart, textbook illustration, or model, trace the flow and surge of blood through the heart and describe the action of the semilunar, tricuspid, mitral, and aortic valves.	An anatomical chart, textbook illustration, or model of the human heart
The students will demonstrate an understanding of heart sounds.	• Demonstrate the use of a stethoscope (or a cardboard tube) to hear heart sounds, and explain what they are. Then have the students listen to their own heart sounds and those of their classmates, noting the differences in rhythm and volume. If possible, let them "see" the sounds on an oscilloscope and/or electrocardiograph. Alter the situation by having the students run in place, do	Page 5 of this publication Stethoscope(s) or cardboard tube(s) Oscilloscope and/or electrocardiograph (Contact the school science department and local health and/or medical centers,

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	calisthenics, or otherwise put added stress on their hearts — and listen and/or chart the heart sounds again. How do they compare with the sounds heard and/or seen before? What do the findings suggest about the operation of the heart as a pump?	cardiologists, and/or college or university science departments.)
	REINFORCEMENT ACTIVITY:	
	✓ Have interested students tape-record their own and/or others' heart sounds and develop a variety of effects from them by re-recording the sounds at different speeds and volumes, using echo techniques, pitting one series of heartbeats against another, etc. Encourage them to use these effects as the basis for creative melodies, dance compositions, light shows, pen or crayon sketches, mood paintings, graphic designs,.... The activity can be modified for use with younger children by recording their heart sounds for them; working with them to develop rhythmic effects; and encouraging them to create simple tunes, songs, dances, fingerpaintings, etc., based on the heart sounds and rhythms.	Taperecorder(s) and art materials
The students will demonstrate an understanding of the cardiovascular system.	• Have the students watch films, filmstrips, and/or videotapes of the heart and circulatory system.	Films, filmstrips, and/or videotapes of the heart and circulatory system (See pp. 107-116 for annotated references to useful materials.)
	• Have younger students walk through the chambers of the heart and the two circuits (the *PULMONARY CIRCUIT* and the *SYSTEMIC CIRCUIT*) on an oversized diagram of the heart and greatly simplified cardiovascular system placed on the floor.	Oversized diagram of the heart and the cardiovascular system
	• Have individual students describe the flow of blood through the heart chambers and the two circuits as they trace it with their fingers on an artist's chart or your own drawing.	Artist's rendition or teacher diagram of the heart and cardiovascular system
	• Distribute copies of a simplified drawing of the heart and cardiovascular system, and have the students trace the flow of blood with red and blue crayons, paints, or felt-tip pens.	Multiple copies of a simplified drawing of the heart and cardiovascular system and red and blue crayons, paints, and/or felt-tip pens
	REINFORCEMENT ACTIVITIES:	
	✓ Have the students who are scientifically and/or mechanically inclined construct a simplified working model (colored fluid through plastic tubing, strings of red and blue miniature Christmas tree lights on a wooden or cardboard background,	Student-selected materials

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	polarized light paper on a transparency for overhead projection, particles of colored metal moved by electromagnetic power over a diagram, etc.) of the heart and cardiovascular system.	
	✓ Ask students who have an interest in auto mechanics to demonstrate a comparison of the cardiovascular system and a water-cooled engine's cooling system.	Model engine and/or flow diagrams
The students will demonstrate an understanding of the types of blood vessels and the functions of each in the human body.	• Discuss the phrase *CARDIO* (heart) *VASCULAR* (vessel) *SYSTEM* and then, using selected reference materials and/or anatomical charts, slides, transparencies, etc., identify the various types of blood vessels and describe their functions in the human body. Relate the functions of each type of vessel to its structure and location.	Selected reference materials and anatomical charts, slides, transparencies, etc.
	• Make the superficial veins in your arm and hand stand out by letting the arm hang down or by restricting the flow of blood for a few seconds with a piece of rope or an improvised tourniquet applied to the upper arm. Trace the course of the veins with your finger. Then have the students repeat the activity, but warn them against restricting the flow of blood for more than a few seconds. Why is this important?	Pieces of rope or improvised tourniquets
	• Find the valves in the veins of your arm by "stripping" or "milking" them. Have the students do the same with their own veins, and then discuss such questions as the following: • How do veins and arteries differ? • Why is there no tangible pulse in veins? • What separates veins from arteries?	
The students will demonstrate an understanding of arterial pulse.	• Snap one end of a long rope and show the students how the energy from the snap travels along the length of the rope. Then, using a garden hose or a soft rubber tube attached to a water faucet, show the pulsations created by the pressure of the water as the faucet is alternately opened and closed. Compare this effect with arterial pulse.	A long rope A garden hose or soft rubber tube attached to a faucet Page 5 of this publication
	• Identify several pulse points on the body, including those at the wrist and near the larynx. Do any of the students have a *visible* pulse?	
	• Have the students cover one ear and listen for a pulse, or suggest that they check it when lying down with one ear on a pillow and a hand or second pillow over the other.	
	• Teach the students to count their own and each other's pulse.	An electric clock with a large

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	This can be done at any of several places on the body where an artery comes close to the surface, but is usually done at the wrist or throat. ***RESTING PULSE RATES*** **are usually derived from 10- or 15-second radial pulse counts taken by placing the pads of the two middle fingers of one hand on the palm side of the opposite wrist, near the base of the thumb. The count is then multiplied by 6 or 4, respectively, and registered in *beats per minute (bpm)*. The students can also determine resting pulse rates by counting the pulse for one full minute — if they don't lose count in the process!** ***EXERCISE PULSE RATES*** **are best determined by treadmill or bicycle ergometry, when heart rates can be measured continuously during the exercise period. However, a 10- or 15-second carotid pulse count taken *immediately after* exercise usually reflects the heart rate *during* exercise within a few beats. Thus the student might do jumping jacks, jog in place, perform a sequence in aerobic dance, etc., and then take a carotid pulse reading. (Place a thumb on the chin and the pads of two fingers of the same hand on the opposite side of the throat near the Adam's apple.) Because the action of the heart returns to normal fairly rapidly, especially if the person is cardiovascularly fit, it is important that the pulse count be short (10 to 15 seconds) and taken immediately after exercise. Converting the count to a 60-second reading yields a fairly accurate exercise pulse rate expressed in beats per minute.**	face and a clearly visible second hand
The students will demonstrate an understanding of the relationship between pulse rate and heart rate.	• Solicit three volunteers to role-play a patient and two doctors. Then have one of the "doctors" determine the "patient's" heart rate with a stethoscope while the other takes his/her pulse at the wrist. Compare the heart rate with the pulse rate. Are they the same or different, and why?	Three students, a stethoscope, and a stop watch or large-faced electric clock
	REINFORCEMENT ACTIVITIES: ✓ In conjunction with their work in English, have the students examine quotations like the following both in and of themselves and as they relate to the work from which they've been excerpted. What do they reveal about contemporary attitudes toward the heart, heart rate, and pulse? *My heart is a kicking horse* *Shod with Kentucky steel!* -Vachel Lindsay, *My Fathers Came from Kentucky*	

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	My pulse, as yours, doth temperately keep time, *And make as healthful music.* -William Shakespeare, *Hamlet* (III, iv, 141-2) *My soul is full of longing* *For the secret of the Sea,* *And the heart of the great ocean* *Sends a thrilling pulse through me.* -Henry Wadsworth Longfellow, *The Secret of the Sea* *I am thane of Cawdor.* *If good, why do I yield to that suggestion* *Whose horrid image doth unfix my hair* *And make my seated heart knock at my ribs,* *Against the use of nature?* -William Shakespeare, *Macbeth* (I, iii, 133-7) *Jog on, jog on, the foot-path way,* *And merrily hent the stile-a:* *A merry heart goes all the day,* *Your sad tires in a mile-a.* -William Shakespeare, *The Winter's Tale* (IV, iii, 132-5)	
	√ In conjunction with their work in mathematics, have the students take their own pulse and calculate the number of times their hearts beat in an hour, a day, a week, a month, ... Average hearts pump 2 1/2 ounces (75 milliliters or cubic centimeters) per beat. Using data from the preceding activity, have the students calculate how much blood their hearts pump in an hour, a day, etc.	Mathematics teachers Stethoscopes and/or stop watches or a large-faced electric clock
The students will demonstrate an understanding of pressure points and their relationship to pulse.	• Have a student take your pulse at the wrist. Then wrap a blood pressure cuff around the upper part of your arm and inflate it. Have your pulse taken again. How does the second count compare with the first? Release the air from the cuff and have a third count taken. How does it compare with the other two? Define *pressure points* and lead the students to an understanding of the relationship between pressure points and pulse. Deal with such questions as why toothaches and headaches throb, and apply the information about pressure points and pulse to a discussion of or activities in first aid.	A student, a stop watch or a large-faced electric clock, and a blood pressure cuff

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
The students will demonstrate an understanding of arterial blood pressure.	• Have the school nurse-teacher, a doctor, or a medical technician demonstrate the proper procedure for measuring arterial blood pressure and explain what is being measured, how it is measured, why it is done that way, and what *systolic* and *diastolic* blood pressures represent. Then have them teach the students how to take their own and each other's blood pressures. The subject should sit in a comfortable, relaxed position with his or her arm on a table, palm up. The cuff should be wrapped in smooth, flat turns around the upper arm at heart level, with the tubes coming out of the bottom of the cuff on the inside of the arm. (The cuff is inflated by squeezing the bulb, and deflated by turning the pin valve on the bulb and letting the air go slowly, but steadily, out.) When the subject and the cuff are in position, place the earpieces of the stethoscope in your ears and the bell over the visible vessels on the inside of the elbow (where the brachial artery branches into the radial and ulnar arteries). Squeeze the bulb until the pressure reaches 100 mm, or until you hear sounds that resemble a heartbeat. If necessary, adjust the location of the bell and/or increase the pressure until the heart sounds can be heard. Then inflate the cuff until the sounds are no longer audible (approximately 180 mm), and *slowly* release the pressure until you begin to hear the sounds again. This point marks the *systolic* phase. Continue to decrease the pressure until the heartbeats begin to sound muffled. This marks the *diastolic* phase. Arterial blood pressure is expressed in millimeters of mercury as systolic over diastolic pressure (e.g., 120/80 mmHg).	Page 5 of this publication *Hypertension Screening in Schools: A Program Planning Guide* (Albany, NY: The University of the State of New York, The State Education Department, Bureau of School Health Education and Services, 1977), pp. 20-27 *Recommendations for Human Blood Pressure Determination by Sphygmomanometers* (American Heart Association, 1967) Sphygmomanometer(s)
	REINFORCEMENT ACTIVITIES:	
	✓ Have interested students use a model of a water-cooled engine cooling system to demonstrate the principles of fluid pressure. How does the system operate? What happens to the pressure if the pump fails or the hose leaks? What happens when the radiator cap is removed while the engine is hot, and why? How do the principles which govern a water-cooled engine cooling system apply to the human cardiovascular system? Lead the students to the conclusion that the pumping action of the heart, clear passageways and elasticity of the vascular pipeline, and a sufficient volume of blood are required to maintain appropriate arterial blood pressure in the human system.	Physics and/or industrial arts teachers A model of a water-cooled engine cooling system

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	✓ Have the students experiment with various instruments and techniques for measuring air pressure, fluid pressure, atmospheric pressure, etc. If appropriate, explain that atmospheric pressure is reported in *inches* of mercury (e.g., 29.5 and falling) and blood pressure in *millimeters* of mercury (mmHg), and show the relationship of inches to millimeters.	Pressure gauges, barometers, sphygmomanometers, etc.

GOAL: HAVING PARTICIPATED IN SUCH LEARNING EXPERIENCES AS THE FOLLOWING, THE STUDENTS SHOULD BE AWARE OF INDIVIDUAL DIFFERENCES IN CARDIOVASCULAR FUNCTION AND SOME OF THE REASONS FOR THEM.

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES

The students will demonstrate an awareness of individual differences in pulse rate and some of the reasons for them.	• Have the students take and record each other's pulse and then compare the results in terms of the students' age, sex, height, weight, general physical condition, involvement in physical activity, use of coffee, tea, colas, alcohol, cigarettes, and/or drugs. What are some of the tentative conclusions that might be drawn from the data?
	
	• Illustrate the infinite variety of individual differences by having the students examine their activities over the past few days and the circumstances under which they were performed, and then compare notes. Do they all travel the same distance to school, via the same route and mode of transportation? Do they all start at the same time? Do they all eat breakfast? or the same things for breakfast? Do they have the same classes? at the same time of day? with the same teachers? Do they have the same habits? the same attitudes toward what should be or is being done? the same relationship to each other? Do they all experience the same events, or react in the same way to the same events when they occur? How do the differences in activity and circumstance — in addition to physical and genetic differences — contribute to differences in pulse rate and blood pressure? What effect might these differences in activity, circumstance, etc., have on pulse rate and blood pressure over time?
	
	• Have the students determine and record their own heart or pulse rates at such times as the following:
	  • After sitting quietly for 2 or 3 minutes
	  • Half an hour after dinner
	  • Before getting up in the morning
	  • After drinking coffee, tea, cola, etc.
		Stop watches and/or a large-faced electric clock

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	• While watching an exciting movie, television program, hockey game, etc. • Immediately after standing up • Just before a test, performance, or competitive event • Immediately after jogging, swimming, or other strenuous activity What tentative conclusions might be drawn with regard to heart or pulse rate differences within the same individual?	
	• Have the students determine and record the heart or pulse rates of relatives, adults in widely different occupations, children and youth from various age groups (1-18), males and females of the same group, cigarette smokers and non-smokers, excessive coffee drinkers, members of a school athletic team, etc. What tentative conclusions might be drawn?	
The students will demonstrate differences in arterial blood pressure and some of the reasons for them.	• Have the students take each other's arterial blood pressure and that of relatives, adults in widely different occupations, children and youth from various age groups (8-18), males and females of the same age group, members of a school athletic team, etc. Are the sounds in the stethoscope the same or different? Then have the students group the results in terms of the other characteristics in their personal profiles, such as age, sex, height, weight, general physical condition, involvement in physical activity, use of coffee, tea, colas, alcohol, cigarettes, and drugs, and compare them by groups and with the pulse rate surveys done earlier (see p. 71). What tentative conclusions might be drawn?	Sphygmomanometers and stethoscopes Pulse rate surveys from the preceding activity and the activity on p. 71
	• Have the students determine and record their own arterial blood pressures at such times as the following: • After sitting quietly for 2 or 3 minutes • Half an hour after dinner • Before getting up in the morning • After drinking coffee, tea, cola, etc. • While watching an exciting movie, television program, hockey game, etc. • Immediately after standing up • Just before a test, performance, or competitive event • Immediately after jogging, swimming, or other strenuous activity What tentative conclusions might be drawn with regard to	Sphygmomanometers and stethoscopes

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	differences in arterial blood pressure within the same individual?	
	• Have the students compare the blood pressure readings taken in the preceding activity with the heart or pulse rates determined earlier for the same series of circumstances (after sitting quietly for 2 or 3 minutes; just before a test, performance, or competitive event; immediately after standing up; etc.). How well do they correlate? What tentative conclusions might be drawn?	Blood pressure readings from the preceding activity and pulse rate determinations from the activity on p. 71-72
	• Check the students' blood pressure readings against the norms on p. 119 and report any marked deviations to the school nurse.	Blood pressure norms on p. 119

GOAL: HAVING PARTICIPATED IN SUCH LEARNING EXPERIENCES AS THE FOLLOWING, THE STUDENTS SHOULD UNDERSTAND AND BE ABLE TO PERFORM SOME SIMPLE TECHNIQUES FOR EVALUATING CARDIOVASCULAR FITNESS.

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
The students will demonstrate that arterial blood pressure is an index of cardiovascular fitness.	• Invite the school nurse-teacher, a doctor, and/or paramedical personnel to discuss high blood pressure (symptoms, types, significance, remediation, etc.) with the students, and help them to establish a blood pressure screening/intervention program for students and adults within the school building.	School nurse-teacher, doctor, and/or paramedical personnel *Hypertension Screening in Schools: A Program Planning Guide* (Albany, NY: The State University of New York, The State Education Department, Bureau of School Health Education and Services, 1977)
	• Divide the class into pairs and have each partner in the pair determine the other's arterial blood pressure (a) before, (b) during, (c) *immediately after*, and (d) 5 minutes after each of the following activities: • Stepping up and down on a 10- or 12-inch bench at a cadence of 20 steps per minute for one full minute • Eight to 10 arm curls, with moderate weight • Riding a stationary bicycle for one full minute • Eight to 10 pushups	10- or 12-inch bench steps and metronome(s) Moderate weights and/or weight machine(s) Stationary bicycle(s)
	Tabulate the findings and have the students develop "norms" for the class. Which activity causes the greatest increase in arterial blood pressure, and why? Are any of the readings consistently much higher for some students than for	

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	others? If one index of cardiovascular fitness is the extent to which blood pressure is affected by exercise, which end of the scale (pressure readings higher or lower than the "norm") seems to reflect the greatest amount of cardiovascular efficiency? Then have the students calculate the differences between the *a*, *b*, *c*, and *d* (see directions on p. 73) readings for each activity, and again determine norms. If another index of cardiovascular fitness is the length of time it takes for arterial blood pressure to return to normal after exercise, what tentative conclusions might be drawn from the differences between the readings for *b* and *c*, *c* and *d*, and *d* and *a*? What are some of the problems encountered in trying to take arterial blood pressure readings during and immediately after exercise?	
The students will demonstrate that low resting pulse rates often indicate high levels of cardiovascular efficiency.	• Have the students determine (by personal contact, research, correspondence, etc.) the average resting pulse rates of their favorite athletes in school, college, professional and/or Olympic competition. Post the results, including the name and resting pulse rate of the researcher.	
The students will demonstrate that heart rate responses to exercise are another index of cardiovascular fitness.	• Have the students count and record their pulse rates (a) just before, (b) *immediately after*, and (c) 5 minutes after completing each of the following activities: • Eight to 10 chinups or arm curls, using a moderate weight • Eight to 10 pushups or bench presses • Ten to 20 situps • An isometric exercise, using the arms • Rope-skipping or running in place for 30 seconds • Stretching exercises After which of these activities is the pulse rate lowest? After which is it highest? Why? How does the pulse count taken 5 minutes after the activity compare with that immediately following? How do the post-exercise pulse counts compare with the resting pulse rate for that day? If another index of cardiovascular health is the length of time it takes the pulse to return to normal (post-exercise recovery rate), what might large differences between the pulse counts in *b* and *c* and *a* and *c* indicate? What tentative conclusions might be drawn if these differences are small? Tabulate the findings and have the students develop "norms"	Stop watches and/or a large-faced wall clock Pulse rate record card (see p. 118) Moderate weights and/or weight machine Jumpropes

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	for the class. Are any of the pulse counts consistently much higher for some students than for others? Did the same students also have higher blood pressure readings in the activity on pp. 73-74? Report any consistently marked deviations in pulse rate and/or blood pressure to the school nurse.	
The students will demonstrate the use of standardized pulse rate recovery tests as a measure of cardiovascular fitness.	• Have the students participate in one or more of the well-known step tests such as the President's Council on Physical Fitness and Sports Recovery Index Test or the following adaptations of the Harvard Step Test:	Page 7 of this publication
	Elementary school boys and girls (adapted by Brouha and Ball) *Bench height:* 14" *Cadence:* 30 steps/minute *Duration:* Below 8 years old - 2 minutes; 8 to 12 years old - 3 minutes *Pulse Count:* 1 to 1 1/2 minutes after exercise *Scoring:* Efficiency Index = $\frac{30,000}{\text{pulse count} \times 5.5}$	*Physical Fitness Research Digest*, President's Council on Physical Fitness and Sports. Series 5, No. 1, January, 1975 14-inch bench step and metronome
	Junior/Senior high school boys (adapted by Brouha and Gallagher) *Bench height:* 18" (for small boys) 20" (for large boys) *Cadence:* 30 steps/minute *Duration:* 4 minutes *Pulse Count:* 1 to 1 1/2 minutes after exercise *Scoring:* Efficiency Index = $\frac{30,000}{\text{pulse count} \times 5.5}$	18- and 20-inch bench steps and metronome
	Junior/Senior high school girls (adapted by Brouha and Gallagher) *Bench height:* 16" *Cadence:* 30 steps/minute *Duration:* 4 minutes *Pulse Count:* 1 to 1 1/2 minutes after exercise *Scoring:* Efficiency Index = $\frac{30,000}{\text{pulse count} \times 5.5}$	16-inch bench steps and metronome
	For most reliable results, it is advisable to tape the instructions on a cassette from a prepared script, using a metronome for the cadence and a stop watch for the pulse count. Tabulate the results.	

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
The students will demonstrate the use of standardized endurance performance tests as an index of cardiovascular fitness.	• Have the students participate in one or more of the well-known endurance performance tests such as the following:	
	• AAHPER 600-Yard Run/Walk Test Directions for administering and scoring the test, and norms for both boys and girls from 7 to 17 are available in the *Youth Fitness Test Manual*.	*Youth Fitness Test Manual*, 1976 ed. (Washington, DC: American Alliance for Health, Physical Education and Recreation, 1976)
	• Cooper's 12-Minute Walk/Run Test Directions for administering and scoring the test can be found in any of Dr. Cooper's books on aerobics. Norms for boys and girls in grades 5 through 8 are also available.	*Aerobics* by Kenneth H. Cooper, M.D. (New York: Bantam Books, 1968)
	• Cooper's 1.5-Mile Run This is easier to score than the 12-Minute Walk/Run Test, but norms are only available for adults.	*The New Aerobics* by Kenneth H. Cooper, M.D. (New York: Bantam Books, 1970)
	• Balke's 15-Minute Run This is similar to Cooper's 12-Minute Walk/Run Test. The number of yards run in 15 minutes at a steady pace can be converted to the number of yards run per minute and this, in turn, can be related to fitness level by the following table:	

Yards per Minute	*Fitness Category*
<150	poor
150-175	fair
175-215	good
215-255	very good
255-290	excellent
>290	superior

Tabulate the results and have the students compare their fitness levels as indicated by endurance performance tests with those derived from step tests.

The students will demonstrate an understanding of the function and/or use of exercise performance tests as an index of cardiovascular health.	• Arrange for the students to have an explanation of and/or to participate in a demonstration of exercise performance tests at a nearby hospital, medical center, or stress testing facility.	Exercise performance testing demonstrators and equipment

GOAL: HAVING PARTICIPATED IN SUCH LEARNING EXPERIENCES AS THE FOLLOWING, THE STUDENTS SHOULD UNDERSTAND THAT THE EFFICIENCY OF THE HEART IS AFFECTED BY A VARIETY OF FACTORS, MANY OF WHICH CAN BE MODIFIED THROUGH CHOICE.

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
The students will demonstrate that cardiovascular efficiency grows with maturity and then declines with age, although the reduction is less significant if one remains physically active.	• Develop a simple form for recording such items as *age, sex, resting pulse rate, blood pressure,* and *general level of physical activity.* Duplicate the form on cards or easily managed sheets of paper, and number them. Have the students use the forms to record the data as they survey people they know "from two to toothless." Local hospitals or medical centers might be able to provide additional statistics, especially with regard to infants and newborn babies. Names should not be used, since this constitutes an invasion of privacy and the numbers alone are sufficient identification for the "subjects" of this "study." Compile the findings. If each student surveys five people and hospital and/or medical center personnel supplement the data, the sample should be large enough and diversified enough for study. If necessary, solicit further information to balance the sample. When the survey is "complete," have the students chart, graph, or otherwise present the data in visual form, and draw some tentative conclusions from it. For example, at what age do resting pulse rates and blood pressure readings seem to be highest? At what age are they lowest? What does the curve look like? Is there a significant difference between the pulse rates and blood pressure readings of people of the same (or nearly the same) age who have different levels of physical activity? What tentative conclusions might be drawn? REINFORCEMENT ACTIVITIES: ✓ Have interested students conduct personal interviews with local and/or professional athletes for a feature article in the school or local newspaper. Such questions as the following might be included: • How long do you intend to be an active competitor in (name the sport)? • What are you doing to "keep in shape"? • What is the usual length of time for successful competitive participation in (name the sport)? Why? • How, and to what extent, can that time be lengthened for a given individual? Ask the students to report these and other aspects of the interview to the class. What tentative conclusions might be drawn, and how can they be applied?	Page 8 of this publication Appropriate survey forms Stop watches, sphygmomanometers, and stethoscopes Local hospital and/or medical center personnel

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	✓ Invite a geriatrics specialist to discuss cardiovascular conditions in older citizens, and the programs designed to meet them. How do cardiovascular conditions relate to overall physical health and well being? What effect, if any, do they have on attitude and general mental and emotional health? How, if at all, can the less desirable characteristics of old age be lessened and/or postponed?	A geriatrics specialist
	✓ Stimulate, design, and implement a physical fitness/heart disease prevention program for adults and/or families in the community.	*Design for Heart Disease Prevention Programs* and a Preliminary Supplement to *Design for Heart Disease Prevention Programs* (The University of the State of New York, The State Education Department, Bureau of General Education Curriculum Development, 1971 and 1976, respectively)
The students will demonstrate that cardiovascular efficiency is nearly equal for boys and girls up to the age of 12, after which it is greater for boys than for girls — with the exception of female athletes.	• Have the students draw some tentative conclusions with regard to cardiovascular efficiency in males and females from the survey described on p. 77.	Data from the survey activity on p. 77
	• Distribute 3 x 5 cards or small sheets of paper and have each student (1) take and record a resting pulse rate, (2) jog and then walk alternate quarters of a lap around the gym for two full laps, (3) take and record a second pulse count *immediately after* completing the second lap, and (4) take and record a third pulse count 5 minutes after the second lap. Then have the students write their gender and age in the upper (or lower) corner of the card or sheet. Post the three counts in six separate columns (*RESTING PULSE RATE: Boys — Girls; EXERCISE PULSE RATE: Boys — Girls; POST-EXERCISE PULSE RATE: Boys — Girls*), grouped according to age, and develop an average for each column. Is the average *resting* pulse rate for girls higher, lower, or the same as that for boys at the same age level? Is the average *exercise* pulse rate for girls higher, lower, or the same as that for boys at the same age level? Is the average *post-exercise* pulse rate for girls higher, lower, or the same as that for boys at the same age level? On this basis, do boys or girls seem to have faster post-exercise recovery rates? If post-exercise recovery rates are one index of cardiovascular efficiency,	Stop watches and/or a large-faced wall clock 3 x 5 cards or small sheets of paper and pens or pencils

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	how well do the results of the experiment relate to the statement in the learning objective?	
	• Have interested students do research on the cardiovascular health of top women athletes and report their findings to the class. How do the resting pulse rates, blood pressure levels, maximal oxygen consumption values, etc., of top female athletes compare with those of other women of the same age? with those of men of comparable age? with those of top male athletes?	
The students will demonstrate an understanding of the fact that people who are in good health have higher levels of cardiovascular efficiency than those who are not in good health.	• Invite the school nurse-teacher or a doctor to explain what is meant by *good health*. Why do physical examinations include pulse counts, blood pressure readings, electrocardiograms, and other measures of cardiovascular efficiency? Why is monitoring these items an integral part of the procedure in major surgery — before, during, and after? What are the *vital signs*, and what do they indicate about the relationship between good health and cardiovascular fitness?	School nurse-teacher or a doctor
The students will demonstrate that climatic conditions have significant effects on cardiovascular performance.	• Discuss the effects of climatic conditions on physical performance and training procedures.	
	• Distribute copies of *Do's* and *Don't's* with regard to jogging in hot, humid weather. What types of things are recommended, and why?	A list of *Do's* and *Don't's* with regard to jogging in hot, humid weather
	• Have interested students keep a record of their resting pulse rates and blood pressure levels for one school year. Each entry should include the temperature and barometric pressure at that period of time. The record (or chart) might also include post-exercise recovery rates. Is there a pattern to the differences? What tentative conclusions might be drawn?	
	REINFORCEMENT ACTIVITIES:	
	✓ Have interested students compare selected environmental conditions (altitude, temperature, barometric pressure, humidity, etc.) with athletic performance at the last five or more summer or winter Olympic Games. What tentative conclusions, if any, might be drawn?	
	✓ Encourage interested students to mount a campaign against smog and other forms of air pollution based on the effects of these conditions on cardiovascular performance.	
The students will demonstrate	• Have the students take and record their temperatures at	Thermometers (try to secure a

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
that slight increases in body temperature usually produce a general improvement in cardiovascular performance, but larger increases produce the reverse.	regular intervals of 2 hours or so from the time they get up in the morning until the time they go to bed at night on a day when they expect to be relatively inactive (a "quiet" day). Are the readings consistent? If not, how much do they vary, when are they highest, and when are they lowest? Then ask the students to keep track of the times of day when they seem to have the greatest , and when they seem to have the least amount of energy. Is there any correlation between body temperature and energy, as perceived in this activity? (REMINDER: Energy is a manifestation of cardiovascular efficiency.)	number of plastic, disposable thermometers from manufacturers and/or distributors for demonstration purposes and/or use in this "experiment.")
	• Discuss physical training and pre-performance procedures, with special emphasis on the *warmup* phase. What are the scientific bases for "warming up"? What happens if the player/performer doesn't warm up, and why?	Pages 29-30 of this publication
	• Suggest that the students record their body temperatures and pulse rates when they have a cold or the flu, etc., which are usually accompanied by a slight fever. Discuss how they feel when they have a cold, etc. Are their energy levels as high? How do resting pulse rates taken at this time compare with "normal" rates for the same individual?	
	• Have interested students research the effects of lowered body temperatures on cardiovascular function and report their findings to the class. Such topics as the following might be appropriate:	
	Frostbite What is it? What causes it? What are its symptoms and/or characteristics? To what extent can its damage be repaired? How and/or why?	
	Ice Baths What function do they serve? How do they affect the cardiovascular system — immediately, and over time?	
	Freezing as a form of anesthetic How is it done? What effect does it have on cardiovascular function?	
	Cryogenics What does the term mean? What kinds of experiments have been done to date, and with what results? What tentative conclusions might be drawn? What implications are there for the future?	

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
The students will demonstrate that the cardiovascular system must work harder when people are upright (standing or sitting up) than when they are horizontal (lying down).	• Divide the class into pairs and have one partner take and record the other's pulse and/or blood pressure while the latter is lying down on his/her back. Then, at a signal, have the person suddenly stand up and the partner take a second pulse and/or blood pressure reading *immediately* afterward. Reverse roles. Is there a difference between the readings for the horizontal and the upright positions? Why, or why not?	Stopwatches and/or a large-faced wall clock Sphygmomanometers and stethoscopes (optional)
	Solicit a random sample of the readings and write them on a chalkboard or newsprint pad. Is the difference between the pulse rates and/or blood pressure levels for the horizontal position and those for the vertical position consistent throughout the sample? Why, or why not? How do the differences correlate with approximate body size, type, and/or weight? What tentative conclusions might be drawn?	Chalkboards or newsprint pads
The students will demonstrate an awareness that cardiovascular activity slows with sleep, responds to the psychomotor stimulus of dreams, and increases as the sleeper approaches waking.	• If the students have pets (particularly dogs), capitalize on their awareness of the animals' behavior while you discuss the effects of sleep on cardiovascular performance. How do the animals look and act when they first fall asleep? when they seem to be dreaming? when they begin to wake up? What tentative conclusions might be drawn at each of these stages? Parallel the animals' behavior and observable cardiovascular characteristics while sleeping with those of human beings in the same state. If possible, have the students take sample pulse readings to test the conclusions.	
The students will demonstrate that cardiovascular performance is affected by the degree to which one's lifestyle is consonant with his/her biological rhythms.	• Discuss the recommendations for sleep in training rules for athletic performance, or have interested students research them by contacting the training managers of their favorite teams. Are the players required to sleep a certain length of time, or between specified hours? Why, or why not?	Training rules for athletic performance
	• Invite the school nurse-teacher or a local physician to discuss the need for sleep. Do all people need the same amount of sleep to function well? Why, or why not? Are some people affected more than others by a lack of sleep? What are some of the effects? To what extent can one make up for a lack of sleep? Is it important that one rest or sleep between specific hours (e.g., 11:00 p.m. to 7:00 a.m.), or be consistent in the choice of hours for sleeping and waking? Is it possible to get too much as well as too little sleep? If so, what are some of the effects of too much sleep? Do people seem to need more, less, or the same amount of sleep as they grow older? Does sleep always produce *rest*? Why, or why not?	School nurse-teacher or local physician

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	• Have the students examine their own living habits over a 1- to 2-week period, or longer. Suggest that they use a diary, an appointment book, or a series of forms to record the time they get up in the morning, when and what they eat and drink, what they do during each waking hour, and when they go to bed each night. Encourage them to include subjective comments as they write. For example, was it hard to get up in the morning? Were there things to look forward to (happily, with dread, etc.)? Did they feel tired, bored, unhappy, depressed, blah, about the same, hopeful, enthused, energetic, etc.? How quickly did they fall asleep at night, and how well do they think they slept? Have the students compare notes and draw some conclusions from them. To what extent might the amount of sleep they had and/or their sleeping habits have contributed to the way they felt? What might some of the other contributing factors have been? To what extent, if any, did the students' keeping a record of their living habits produce a change in those habits?	Diaries, appointment books, or a series of forms
	• Discuss and/or have interested students report on *biological rhythms*.* What does the phrase mean? How do people determine their biological rhythms and make them work for them? What effect might biological rhythms, and one's living in accordance with them, have on cardiovascular efficiency?	*An Introduction to Biological Rhythms*, by John D. Palmer (Campbell, California: Academy Press, 1970) *An Introduction to Biological Rhythms*, by David C. Saunders. Tertiary Level Biology Series. (New York: Halsted Press, 1977)
The students will demonstrate that thinking and emotion are internal forms of work which increase cardiovascular activity in much the same way as any other form of work.	• Divide the class into pairs. Have one partner take and record the other's pulse rate while at rest, and then monitor it while the "subject" *mentally* performs a physical activity such as raising one arm, pulling a door open, pitching a baseball, playing a musical instrument, jumping rope, swimming laps, washing a car, etc. Is there a significant difference between the resting pulse rate and the rate monitored while the subject was engaged in vicarious activity? Why, or why not? What tentative conclusions might be drawn?	*Direct Electrical Measurement of Mental Activities in Action-Potentials*, by Edmund Jacobson, M.D., Ph.D. (Hull Physiological Laboratory, University of Chicago). A compilation of research papers reprinted from *The American Journal of Physiology*, 1930-31 — but still the leader in its field. Articles include Electrical Measurements of Neuromuscular States During Mental Activities: I. Imagination of Movement Involving Skeletal Muscle (Vol. 91, No. 2,

* Not to be confused with *biorhythms*, "a popular system for predicting future ups, downs, and critical days from an individual's birth date."

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	• Describe some of the techniques for getting players "all psyched up" before a competitive event, and discuss the reasons for them. What effects do they have on a player's cardiovascular system? How long do the effects usually last?	Jan. 1930); II. Imagination and Recollection of Various Muscular Acts (Vol. 94, No. 1, July 1930); III. Visual Imagination and Recollection (Vol. 95, No. 3, Dec. 1930); IV. Evidence of Contraction of Specific Muscles During Imagination (Vol. 95, No. 3, Dec. 1930); V. Variation of Specific Muscles Contracting During Imagination (Vol. 96, No. 1, Jan. 1931); VI. A Note on Mental Activities Concerning an Amputated Limb (Vol. 96, No. 1, Jan. 1931); VII. Imagination, Recollection and Abstract Thinking Involving the Speech Musculature (Vol. 94, No. 1, April 1931); and Electrophysiology of Mental Activities (University of Chicago)
	REINFORCEMENT ACTIVITY:	
	✓Have the students watch selections from Jonathan Reynolds' *Yanks 3, Detroit 0, Top of the Seventh*. How do the pitcher's thoughts and emotions while on the mound cause him to snatch defeat from the jaws of victory? What probable effects did they have on his cardiovascular system, and why?	Videotape copy of selections from Jonathan Reynolds' *Yanks 3, Detroit 0, Top of the Seventh* (Available from the Bureau of Mass Communications, State Education Department, Albany, NY 12234)
The students will demonstrate that tension or "psychic stress" can be damaging to cardiac efficiency because it increases pulse rate; creates a desire to chew, smoke, smash, "drink," and/or pop a pill; often interferes with sleep; and generally results in physical and emotional fatigue.	• Use a current happening to open a discussion of the adventure and the difficulties of living in "a world we never made." What are some of the problems with which people must cope on a day-to-day basis? By what means do they seem to be attempting to cope with them? What are some of the effects apparently produced by the situations and/or the solutions? Work from the general to the specific, creating a provocative but nonthreatening atmosphere that will lead the students to examine their own living conditions, responses, and results. Continue the discussion over time with individual students and/or the class as a whole, as appropriate.	
	• Ask the students to take and record a pulse count the next time they feel tense or nervous and jot down the probable cause and whatever they do, if anything, to compensate for it. At the beginning of the next class, distribute 3 x 5 cards and have the students identify on one side the things	3 x 5 cards

that make them feel tense or nervous (one item per card) and on the other, the things they do to compensate. Collect the unsigned cards and develop a series of problem statements from them. During the next class, or in conjunction with health education, have the students work in groups to brainstorm possible solutions to the problems, categorizing them according to (1) those that could be damaging to cardiovascular performance and (2) those that, by preventing or alleviating nervous tension, could be beneficial to it.

Encourage the students to experiment with the positive suggestions, and do a periodic check with individual students and with the class as a whole in an effort to develop and/or reinforce beneficial behaviors. How do specific students look and act? Are they more at ease, without being lethargic? Do they perform better in class? Do they seem to chew, smoke, smash, "drink," pop pills, or whatever less frequently? Do they sleep better at night? Do they appear to be generally healthier and in better spirits?

If and when appropriate, repeat the card activity. Is there any difference in the items identified as causes of nervous tension? in the number of items cited? in the compensations or solutions? Are there any new items in the list?

3 x 5 cards

- Have the students host a talk show with a cardiologist, a physician, and/or a member of the local chapter of the American Heart Association in a discussion of the effects of nervous tension or psychic stress on cardiovascular function. If possible, videotape the show for future use on closed circuit television.

REINFORCEMENT ACTIVITIES:

✓ In conjunction with their work in art education, the students might examine such expressions of the human condition as Bruce Conner's *Child:* Degas' *The Glass of Absinthe;* Lu Duble's *Cain;* Goya's *Disasters of War: And They Are Wild Beasts;* Louis Guglielmi's *Terror in Brooklyn;* Paul Klee's *Flight From Oneself;* Käthe Kollwitz's *Death and the Mother;* Wilhelm Lehmbruck's *Young Man Seated;* the *Laocoön* group; Berta Margoulies' *Mine Disaster;* Michelangelo's *Pietà;* Edvard Munch's *Puberty, The Scream,* and *The Dead Mother;* Picasso's *Guernica;* David Alfaro Siqueiros' *Echo of a Scream* and *New Democracy;* and Andrew Wyeth's *Christina's World.* What are the conditions expressed in each case, and what are the victims' responses to them? What are the probable effects of these conditions and responses on the cardiovascular system in

Appropriate works of art

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	each case? Encourage the students to develop their own expressions, in any medium, of their perceptions of and responses to the conditions of life which seem to have the most immediate effect on them.	
	✓ In conjunction with their work in English, the students might discuss and/or illustrate futurist Alvin Toffler's concern that we are in the midst of "a collision between an accelerative push forever pressuring us to live faster, to adapt more quickly, to make and break our environmental ties more frequently, to make speedier decisions, and the equally powerful counterpressures of novelty and diversity which demand that we process more data, that we break out of our old, carefully honed routines, that we examine each situation anew before we make a decision. ... The blunt fact is that there are certain upper limits on how much sensory input we can handle, how much information we can process, the number and kind of decisions we can make in a given interval. Today, as change escalates out of all proportion, we are forcing millions of human beings to operate above their adaptive range." What probable effect will or do these conditions have on cardiovascular performance?	*Future Shock*, by Alvin Toffler (New York: Random House, Inc., 1970)
The students will demonstrate that cardiovascular activity is greater during the ingestive and digestive stages of food processing than during the post-absorptive stage.	• Have the students take and record a pulse count before, during, immediately after, and about an hour after their major meal each day for a week, and then compare entries. What tentative conclusions might be drawn, and what are some of the possible reasons for them?	
	• Discuss pre-performance regulations for athletic competition and such "family" rules as waiting an hour before swimming after meals.	
The students will demonstrate that cardiovascular function is affected by the type as well as the amount of food ingested.	• Have the students keep a record of their pulse rates before, during, and immediately after a light meal (lunch or supper) and the major meal (dinner) of each day plus *what* they ate at these times — for one full week. Then have them compare the entries and draw some tentative conclusions from them.	
	• Have the students host a talk show on a topic such as "Eating to Your Heart's Content" with a cardiologist, a nutritionist, and a medical technician who has expertise in lipoprotein analysis. Encourage your guests to bring visuals and/or be prepared to demonstrate their points of view. Are calories the only concern? Is dieting the answer? What is the real question? How can we determine	A cardiologist, a nutritionist, and a medical technician with expertise in lipoprotein analysis Videotaping equipment (optional)

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	what we need? If possible, videotape the performance as another in a series of local resources on heart disease intervention. REINFORCEMENT ACTIVITY: ✓ Since the students' meals (and some of the snacks) are usually determined by adults in the household, it is advisable to involve the adults as soon as possible in this aspect of the school's physical education program. Thus the "talk show" described above might be scheduled as an evening activity preceded by a "hot dish supper" or an international smorgasbord which would not only provide a medium for socialization, but would also be a point of departure for the program to follow — and a valuable lesson in ethnic applications of nutritional requirements.	
	• Develop a visual display and/or a readily available resource collection of materials related to the effects of food on cardiovascular function. Use the films, filmstrips, books, articles, posters, etc., in class and encourage students to use them on their own time.	Resource materials such as *Healthy Eating for Teenagers* (a 6-page reprint), *Heart Diet Quiz* (a cardboard display in color), *Diet and Heart Disease* (a 4-page leaflet), diet posters, and *Development of Atherosclerosis* (4 slides in black and white) — all available from the local chapter of the American Heart Association
The students will demonstrate that the need for and use of energy differs from one individual to another.	• Have the students list, draw, or cut-and-paste pictures of the things they eat and then assign values to each in terms of its effect on cardiovascular fitness. (Items in the visual display/resource collection alluded to above should be useful in developing a scale.) Encourage the students to compare notes and discuss their observations. In general, do they eat the same types of foods? If not, what are the similarities and what are the differences? Do the students eat about the same amounts of similar foods, or are there wide differences? How does *energy input* appear to relate to *energy need* in each case, as evidenced by the individual's body size and build and level of physical and/or emotional activity? Finally, have the students examine their food habits in terms of the cardiovascular and/or physical fitness levels included in their school records. What tentative conclusions might be drawn?	Individual student cardiovascular and/or physical fitness level scores
The students will demonstrate an understanding that water and	• Discuss (or invite a coach from a professional team to discuss) provisions for fluid intake before, during, and after	Page 12 of this publication

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
electrolyte solutions are essential to the maintenance of normal body temperature and a relatively stable internal environment, especially during prolonged physical workouts and competitions.	prolonged physical workouts and competitions, and the reason for those provisions. Are there any cautions to be observed with regard to time, amount, type, etc., of liquid input?	Coach from a professional team (optional)
The students will demonstrate an awareness that stimulants such as coffee, tea, and cola-type beverages increase heart rate, raise blood pressure, and have an adverse effect on the central nervous system when consumed in quantity, on an "empty stomach," and/or over time.	• Have the students develop a form and work in teams to interview a group of people from various age levels re their intake of coffee, tea, and/or cola. Numbers can be substituted for names, if desired, and sufficient space reserved at left or right for the interviewer's comments and observations (see sample given below).	Page 12 of this publication
	Then have the teams compile their reports, categorize the data, and draw some tentative conclusions from it. Do the interviewees who consume large amounts of coffee, tea, and/or colas appear to be more active, nervous, high-strung, or whatever than those who consume smaller amounts? Are there any differences in consumption and/or apparent effects among people in specific age groups?	
The students will demonstrate an awareness that small amounts of beverage alcohol produce a mild, tranquilizing effect but larger concentrations make the heart work harder and, over time, contribute to obesity, malnutrition, ruptured capillaries, depression of the nervous system, and ultimate destruction of tissues of the digestive system and the brain.	• Invite a consultant from ALANON or ALATEEN to speak at a general assembly or discuss with the class the physiological and psychological aspects of drinking beverage alcohol.	Pages 12-13 of this publication Consultant/speaker from ALANON or ALATEEN
	• Have the students watch a sound/color film or filmstrip on the use and effects of beverage alcohol, and then discuss their observations and conclusions.	*Audio-Visual Materials on Alcohol and Alcoholism* (H.E.W. Publication No. ADM 74-32, available from the National Clearinghouse for Alcohol Information, P. O. Box 2345, Rockville, MD 20852)

SUBJECT	AGE	COFFEE (Cups/ day)	TEA (Cups/ day)	COLA (Am't/ day)	COMMENTS/OBSERVATIONS

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	• Have the students read and discuss segments of *The Drinking Game and How to Beat It* (1970), a text which presupposes the desirability of moderate drinking and is therefore of specific value to students who wish to become or remain "safe, social drinkers."	*The Drinking Game and How to Beat It* (The Benjamin Company, Inc., 485 Madison Avenue, New York, NY 10022)
	• Develop, or encourage the students to develop, a 3-dimensional display and/or a readily accessible collection of resources related to the psychological and physiological effects of beverage alcohol. Use the films, filmstrips, books, articles, posters, etc., in class and encourage the students to use them on their own time. Then play a quiz game. Solicit two scorekeepers and divide the remainder of the class into two teams. Ask each team to select a captain and then develop a series of significant questions on 3 x 5 cards. During the next class, have the captains toss a coin for the right to ask the other team the first question. Alternate questioner/answerer roles, letting each team operate as it sees fit (e.g., as individual team members, as a group, as spokespersons with "resource" backups, ...), and score one point for each correct answer. The team with the greatest number of points at the end of the session wins the game.	National Clearinghouse for Alcohol Information (P. O. Box 2345, Rockville, MD 20852). An excellent source of pamphlets, posters, bumper stickers, a monthly newsletter, and a quarterly bulletin—all without charge. An order form has been included in *Alcohol Education: A Teacher's Guide for Grades 7-12.* (The University of the State of New York, The State Education Department, Bureau of Drug Education, Albany, NY 12234). This publication and its companion guide for grades K-6 contain a great deal of additional information about the use and abuse of beverage alcohol, including the behavior in the body (pp. 64-71), a blood alcohol chart (p. 108), a form for surveying the drinking habits of children and youth, and a form to be used by students to evaluate their learning experiences with regard to beverage alcohol.
The students will demonstrate that smoking increases pulse rate and blood pressure.	• Invite a smoker to demonstrate that tobacco smoke contains tars which, if inhaled, will coat the inner lining of the lungs. Ask the smoker to: (1) Take a deep puff from a lighted nonfiltered cigarette, hold as much of the smoke as possible in the mouth, and then blow through a clean white handkerchief held firmly across the lips. (2) Take a second deep puff, this time inhaling the smoke into the lungs before blowing it through another clean white handkerchief. The stain produced by the smoke that was held in the mouth and then exhaled should be much darker than that produced	A smoker; a cigarette; and two clean, white handkerchiefs

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	by the smoke that was drawn into the lungs and then exhaled. Why? If this procedure were repeated over time, what tentative conclusions might be drawn?	
	• Display a plastic smoking model in a prominent place so that students can watch the accumulation of cigarette tars in the "lungs." If the condition of a smoker's lungs resembles that of the model's lungs, what probably happens to the smoker's ability to move oxygen, carbon dioxide, and other gases from the lungs to the bloodstream and reverse? What effect does this situation probably have on cardiovascular efficiency?	A plastic smoking model
The students will demonstrate an awareness of the fact that smoking has a deleterious effect on cardiovascular performance.	• Develop an effective display and readily accessible collection of learning resources related to the causes and effects of smoking. Use the films, filmstrips, books, articles, posters, etc., in class and encourage students to use them on their own time.	National Clearinghouse for Smoking and Health (Center for Disease Control, 1600 Clifton Road N.E., Atlanta, GA 30333) American Lung Association (766 Ellicott Street, Buffalo, NY 14203) Roswell Park Memorial Institute (666 Elm Street, Buffalo, NY 14263)
	• Invite a cardiologist or a representative of the local chapter of the American Heart Association to explain and/or demonstrate the effects of smoking on cardiovascular health — with special emphasis on the effects of carbon monoxide. Then give the students an objective test (avoid True/False items) on the substance of the presentation.	A cardiologist or a representative of the local chapter of the American Heart Association
The students will demonstrate an awareness of the fact that drugs produce a variety of effects on the cardiovascular system. The students will demonstrate that, because of the effects they can produce, drugs should be taken only by prescription from a doctor.	• Invite a cardiologist, a pharmacist, a physician, or a representative from the local chapter of the American Heart Association to present an illustrated discussion of the effects on the cardiovascular system of such readily available drugs as aspirin or the histamines, as well as "hard" or prescription drugs such as amphetamines, barbiturates, coagulants, vasoconstrictors, vasodilators, and heart stimulants.	A cardiologist, a pharmacist, a physician, or a representative from the local chapter of the American Heart Association
	• Develop an effective display and/or readily accessible collection of resources about both direct and side effects of drugs on human beings. Encourage the students to contribute to and use the collection/display, and solicit contributions from local, state, and national organizations concerned about the safe use of drugs.	Alcohol and Drug Problems Association of North America (1130 17th Street, N.W., Washington, DC 20036)

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	REINFORCEMENT ACTIVITIES: ✓ In conjunction with their work in art education, interested students might develop a mixed media expression of a human being's reactions to a given drug. ✓ In conjunction with their work in English education, interested students might express the effects of drugs on human systems in a creative essay, a "stream-of-consciousness" type of short story, a poem a la E. E. Cummings, etc.	
The students will demonstrate that short-term, high-intensity activities with rapid, dynamic movements produce immediate, inordinate increases in pulse rate and blood pressure.	• Divide the class into pairs, and have each partner take and record the other's resting pulse rate and/or blood pressure. Then have one of the partners do a short-term, high-intensity activity such as sprinting, speedskating, broad- or high-jumping, running hurdles, a gymnastic exercise, etc., followed by an *immediate* pulse count and/or blood pressure reading. Reverse the roles. What happens to the pulse and/or blood pressure in each case?	Large-faced wall clock and/or stopwatches Sphygmomanometers and stethoscopes (optional)
The students will demonstrate an understanding of the reasons why short-term, high-intensity activities with rapid, dynamic movements DO NOT improve cardiovascular health and might even be damaging to it.	• In discussing the results of the preceding activity you might draw comparisons between the types of exercise performed above and such periodic cardiovascular "killers" as shoveling snow and pushing cars out of ditches or snowbanks. Under what conditions are these types of activity liable to be dangerous? How, or under what conditions, can they be performed with relative safety, with even some benefit to the individual?	
The students will demonstrate that isometric activities produce small increases in pulse rate, but large increases in blood pressure. The students will demonstrate an understanding of the reasons why isometric activities DO NOT improve cardiovascular health and might even be damaging to it.	• Divide the class into pairs or small groups, and have the partners or group members take and record each other's resting pulse rate and blood pressure. Then have alternate partners or group members do isometric activities such as wrestling or weightlifting, followed by an *immediate* pulse count and blood pressure reading. How do these compare with the resting pulse rates and blood pressure readings taken earlier? Why DON'T isometrics improve cardiovascular health, and under what conditions might they be detrimental to it? Discuss.	Large-faced wall clock and/or stopwatches Sphygmomanometers and stethoscopes
The students will demonstrate an understanding of the fact that aerobic activities produce a variety of effects that DO improve cardiovascular health.	• Show a film such as *Run Dick, Run Jane* which deals with the effects of aerobic exercise on cardiovascular health. Why didn't the additional stress from the exercise prove fatal? Why, instead, did the man's condition improve? Follow the discussion with *Coronary Counter Attack*, a sequel to *Run Dick, Run Jane*.	Pages 14-15 of this publication *Run Dick, Run Jane* (Brigham Young University Films). 20 min. sd. color. 16 mm. 1971.

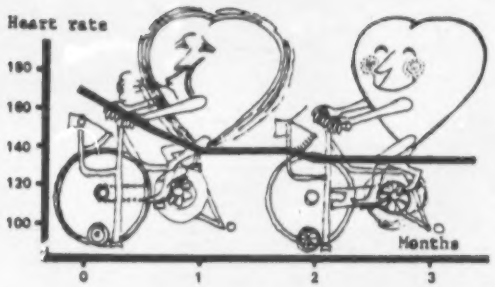
OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
		Coronary Counter Attack (Brigham Young University Films). 20 min. sd. color. 16 mm. 1972.
	• Have the students read all or selected chapters from *Aerobics, The New Aerobics,* or *Aerobics for Women.* Then have the students demonstrate their understanding of the effects of aerobic exercise on cardiovascular health by sketching or cutting-and-pasting pictures of physical and/or recreational activity (swimming, tennis, bowling, volleyball, disco dancing, watching television, playing backgammon, etc.) and labeling them according to Cooper's point system. Display the pictures and have the students identify those activities in which they are regular participants. Then ask them to take a resting pulse count. Is there any observable correlation between resting pulse rates and levels of participation in aerobic and non-aerobic activity? What tentative conclusions might be drawn?	*Aerobics* (1968) and *The New Aerobics* (1970), by Kenneth H. Cooper, M.D. (New York: Bantam Books) *Aerobics for Women,* by Kenneth H. and Mildred Cooper (New York: Bantam Books, 1972) Student-made pictures of physical and/or recreational activity Large-faced wall clock and/or stop watches
	• Use a resource like William J. Tomik's slide/tape module, *Cardiovascular System and Exercise,* as the basis for class and/or individual discussion.	*Cardiovascular System and Exercise,* a slide/tape module developed by William J. Tomik, Professor of Physical Education, State University College at Cortland (Available from the Sperry Learning Resources Center, State University College at Cortland, Cortland, NY 13045)
	• Define *aerobic activity.* What are its characteristics? How does it differ from other types of physical and/or recreational activity?	A Glossary of Terms, p. 99
	• Explain, or invite a cardiologist to explain, the principle of *venous return.* Tape the presentation and include it in a collection of resources on cardiovascular health.	Page 11 of this publication A cardiologist (optional)
	• Develop and ask the students to contribute to an effective collection and/or display of multimedia resources related to the effects of aerobic exercise on cardiovascular health.	The local chapter of the American Heart Association, the National Heart and Lung Institute, the American Alliance for Health, Physical Education and Recreation, etc.

GOAL: HAVING PARTICIPATED IN SUCH LEARNING EXPERIENCES AS THE FOLLOWING, THE STUDENTS SHOULD BEGIN TO ADOPT LIFESTYLES WHICH WILL IMPROVE OR, IF ALREADY HIGH, MAINTAIN THEIR LEVELS OF CARDIOVASCULAR HEALTH.

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
The students will demonstrate the ability to do anthropometric measurements for height, weight, girth, and bone diameter.	• Demonstrate the proper use of a stadiometer or wall chart and a weight scale. Then divide the class into groups of two and have one partner in each pair record the other's height (standing tall, without shoes) and weight (with minimal clothing, no shoes). Have the students reverse roles and repeat the procedure.	Stadiometer or wall charts and weight scales
	• Demonstrate the proper use of measuring tapes and then divide the class into pairs and have each partner use a tape to measure the circumference or *girth* of the other's chest, waist, hips, thigh, forearm, and wrist in the following manner: *Chest* Wrap the tape around the chest just below the armpits and pull it into a close fit. Measure at the nipple in both expanded and exhaled positions. *Waist* Wrap the tape around the waist at the level of the navel and pull it snug, with the abdomen relaxed. *Hips* Measure with the tape pulled snugly at the widest portion of the hip. *Thigh* Pull the tape snug and even around the right thigh, midway from the knee. *Forearm* Measure the right forearm at the widest point. *Wrist* Wrap the tape snugly around the wrist just above the widest part at the wrist. Ask the students to take two or three measurements of each part and record the average.	Measuring tapes
	• Demonstrate the proper use of calipers to measure bone diameters and then have the students measure each other's wrist, knee, shoulder, and hip diameter in the following manner:	Calipers

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	Wrists Adjust the calipers to measure the widest diameter of the left and the right wrists. *Knees* Have the student sit with legs relaxed, and measure the diameter of each knee at the bottom level of the kneecap. *Shoulders* Measure from front to back at the tip of each shoulder, not including the muscle. *Hips* Measure the diameter of the hip at the crest of the ilium.	
The students will demonstrate the ability to identify somatotypes.	• Describe the characteristics of the three basic body structures or *SOMATOTYPES* identified by Dr. W. H. Sheldon: the *ENDOMORPH*, the *MESOMORPH*, and the *ECTOMORPH*. Explain that his classifications are based on the percentages of fat, muscle, and bone in the body — each component being rated on a scale of 1 to 7 — and that although there are a few "pure" ectomorphs, etc., most people have relative somatotypes such as endo-mesomorph or meso-ectomorph. Then have the students determine their own and each other's somatotypes. REINFORCEMENT ACTIVITY: ✓ Distribute copies of the somatotype/personality type assessment sheet on p. 126 and have interested students complete the test for themselves and/or others. If the highest of the three totals is in the first column, the student's traits are predominantly endomorphic; if the highest total is in the second column, they are predominantly mesomorphic; and if the highest total is in the third column, the traits are predominantly ectomorphic. Close totals represent a combination of somatotype personality traits.	Somatotype/Personality Type Assessment Sheet (See p. 126 of this publication.)
The students will demonstrate the ability to test for obesity.	• Have the students do any or all of the tests for obesity described on pp. 124-125.	Tests for obesity (See pp. 124-125 of this publication.)
The students will demonstrate the ability to determine desirable personal weights.	• Have the students determine desirable personal weights from a chart like the one on p. 122.	Desirable weight chart for teenage boys and girls (See p. 122 of this publication.)

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
The students will demonstrate the ability to approximate energy input and output during a 24-hour period.	• Have the students keep a 3-day log of their energy *input* (everything eaten and/or drunk before, during, between, and after meals, with approximate amounts and caloric values) and energy *output* (such activities as walking, sleeping, playing tennis, climbing stairs, etc., with approximate amounts and caloric values). Remind them to include *negative work* as well (see explanation on p. 121). Then ask the students to total the energy input and output values for each of the three 24-hour periods, derive an average, and analyze the results. If the input exceeds or is less than the output, have the students multiply the difference by 7 to determine an average weekly difference and then divide that figure by 3500 (3500 calories = 1 pound of fat) to project an average gain or loss in weight per week.	Caloric energy charts (See *Facts About Figures*, a New York State Department of Health publication; health/food/nutrition texts; or commercially produced guidebooks on calories and/or carbohydrates.) Energy expenditure charts
The students will demonstrate the ability to improve the ratio between energy input and energy output.	• Generate a discussion of human behavior and have the students examine their own behaviors in relation to the items discussed. For example, how do they cope with or try to prevent (you might distinguish between *prevent* and *avoid*) situations which create or magnify the tensions in their lives? What kinds of choices do they make from among the foods and beverages available to them? Do they get plenty of exercise every day — especially through things they *like* to do? How well do they sleep at night? Try to guide the discussion toward conclusions about the ratio between energy absorbed and energy expended.	
	• Develop and implement a well-designed aerobic fitness program.	"Three Sample Aerobic Conditioning Programs" (See pp. 27-62 of this publication.)
	• Explain the meaning and significance of the term *training stimulus* and teach the students how to determine their own optimal target heart rates from the Karvonen Training Stimulus Formula on p. 16 of this publication. Then help the to design and implement personal aerobic fitness programs suited to their individual needs and characteristics.	Karvonen Training Stimulus Formula (See p. 16 of this publication.) *Beyond Diet: Exercise Your Way To Fitness and Heart Health*, by Lenore R. Zohman, M.D. (available from the local chapter of the American Heart Association), 1974; *Aerobics* (New York, Bantam Books, 1968) and *The New Aerobics* (New York: Bantam Books, 1970), by Kenneth H. Cooper, M.D.; and *Aerobics for Women*, by Kenneth H. and Mildred Cooper (New York: Bantam Books, 1972)

OBJECTIVES	LEARNING EXPERIENCES	RESOURCES
	REINFORCEMENT ACTIVITIES:	
	✓ The students might participate in ball gymnastics as a warmup for later aerobic activity until they become proficient enough to perform ball routines which are sufficiently demanding to raise their heart rates to training stimulus levels.	*Ball Gymnastics*, L.P. 4030 and instruction manual by Annelis Hoyman (Deal, NJ: Kimbo Records, 1967)
	✓ In conjunction with their work in art education, the students might:	Art teacher(s) and materials
		
	• Develop montages, collages, or sculptures which illustrate aerobic activity. • Use mobile or otherwise changing formats to express the effects on aerobic fitness of activity and/or inactivity, appropriate and/or inappropriate nutrition, and "internal pollution" (smoke, alcohol, drugs) or the lack of it. • Draw cartoons or comic strips about aerobic fitness, physical performance, or bodily function. • Design parcours, bicycle paths, and other types of community physical fitness/recreation areas.	
	✓ In conjunction with their work in English education and/or media studies, the students might:	English and/or media studies teachers
	• Do impromptu expressions of such conditions or attitudes as stress, obesity, thinness, physical and/or mental exhaustion, happiness, victory, good health, etc. • Use comparison/contrast techniques in a prose composition or discussion/demonstration of human needs, lifestyles, and life expectancies in the past, present, and/or future. • Develop promos for aerobic fitness, or public service announcements for local fitness-oriented events that might be used on radio or television. • Secure sponsors and air time for the promos and/or psa's described above.	
	• Motivate the students to (1) adjust their energy input to demonstrated needs; (2) substitute apples, bananas, nuts, raisins, etc., for junk foods when snacking; (3) make nutritional choices of food and beverage, when choices are possible; and (4) encourage their parents/guardians to maintain high nutritional standards for meals at home.	

OBJECTIVES

LEARNING EXPERIENCES

RESOURCES

REINFORCEMENT ACTIVITIES:

√ In conjunction with their work in home economics education, the students might:

- Develop a "recommended guide to good eating" which features ethnic foods (tacos, black-eyed peas, cabbage rolls, ...) for each of the four basic food groups.
- Design, prepare, and serve an "international meal" or a smorgasbord of international foods which satisfy the basic nutritional needs.
- Make their own granola (see recipe at right) and/or nut butters (peanut, walnut, hazelnut, or mixed nut).

GRANOLA

2 1/2 c. oats
1 c. shredded cocoanut
1/2 c. coarsely chopped almonds
1/2 c. sesame seeds
1/2 c. sunflower seeds
1/2 c. wheat germ
1/2 c. honey (optional)
1/4 c. cooking oil

Combine all the dry ingredients in a large bowl and mix thoroughly. Add the oil (or, if sweet granola is preferred, the oil and honey) and thoroughly mix again. Spread the mixture evenly in a 13 x 9 x 2 pan and bake at 300° for 40 to 50 minutes or until golden brown, stirring every 15 minutes. Remove the granola from the oven and put it into another pan to cool, stirring occasionally to prevent lumping. Add a half cup of raisins, dried currants, chopped dried apricots or prunes, etc., if desired, and store in a tightly covered jar or plastic bag.

PROGRAM APPLICATIONS AND EXTENSIONS

Well-designed programs in fitness education provide a variety of opportunities for application and extension. For example, schools might begin to install more comprehensive medical/physical/psychological screening tests in order to identify existing or potential fitness problems such as malnutrition, high blood pressure, hypertension, perceptual/motor difficulties, and mental or emotional disorders in time to bring about successful intervention. This, in turn, should result in closer working relationships, greater understanding, and a shared sense of responsibility among teachers, physicians, parent/guardians, personnel from community health and recreation groups — and the students themselves — for each individual's total development. Parts of the fitness curriculum might be implemented by or infused into other subject areas. Teachers themselves might be inspired to substitute exer-

cise and scientific relaxation for cigarettes and coffee during their lunch or "free" periods. Parents might plan more family outings, join community fitness and/or recreational programs, develop lower calorie/more nutritional eating habits, and make other healthy changes in lifestyle. Hospitals, public and private health organizations, and commercial enterprises which are responsible for health-related products or services might work more closely with schools in developing experience-based learning programs in their respective spheres of operation. Finally, interested students might be encouraged to:

- Form jogging, cycling, aerobic dancing, etc., clubs.
- Do indepth studies of various aspects of fitness education (e.g., comparative lifestyles in countries with high — or low — fitness levels; the interrelationship between environment, socioeconomic conditions, diet, and lifestyle with regard to its effect on physical health and development; genetic differences and similarities as they relate to athletic potential; causes and effects of high blood pressure; nutrition for athletes; anthropometric techniques and instruments; ATP; etc.).
- Develop short-term research projects on such things as the effect of regular physical/recreational activity and/or a particular type of diet on one's appetite; ability to sleep; appearance; response; attendance in school; ability to cope; and academic, athletic, or physical work performance.
- Complete major sequences in exercise physiology, including indepth studies of sports physiology, the application of physiological research to the training and conditioning of athletes, and independent study or field service projects.
- Become peer teachers or teaching assistants for school and/or community-based fitness education programs.
- Design and implement advertising programs for fitness education, heart disease prevention, anti-smoking/drug/alcohol campaigns, etc.
- Work with personnel from local chapters of the American Red Cross, the American Heart Association, and various community service clubs on bloodmobile programs, heart disease screening and prevention programs, cardiorespiratory resuscitation programs, public school and community-based health and recreation programs, etc.
- Explore career potentials in exercise physiology, sports medicine, physical therapy, public health, health and physical education, anthropometry, calorimetry, hematology, cardiology, neuromuscular measurement and analysis, pediatrics, geriatrics, weight control, tension control, professional coaching, and recreational fitness program management in business/industry and such community service organizations as the YMCA, the YWCA, and the Jewish Community Center.

The possibilities for application and extension are limited only by the designer/implementer's imagination and the particular circumstances which surround the program.

Teacher-devised Activities

A Glossary of Terms

Adenosine triphosphate (ATP)- an amorphous ester ($C_{10}H_{12}N_5O_3H_4P_3O_9$) of adenosine and triphosphoric acid that occurs in living cells and plays a fundamental role in most of the biochemical processes that either produce or require energy, especially those related to the work of muscular contraction.

Adipose tissue - a form of connective tissue consisting of fat cells locked in a loose network of fibers and arranged in lobules along the course of small blood vessels.

Aerobic - requiring free oxygen in order to live or take place.

Aerobic exercise - physical activity which is energized by the oxygen-dependent metabolic systems within the muscle, thereby challenging the respiratory (oxygen intake) and cardiovascular (oxygen transport) systems and improving the general efficiency of all the oxygen-utilization systems in the body. Examples: jogging, swimming, cross-country skiing.

Alveoli - small, pit-like air cells in the lungs.

Amphetamines - sulfate or phosphate forms of alpha-methyl-phenyl-ethyl-amine used as a stimulant for the central nervous system. *Benzedrine* ("bennies") is a trademark for amphetamine as a sulfate salt.

Anerobic - living or taking place without the use of free oxygen.

Anerobic exercise - short-term, high-intensity physical activity that requires a sudden spurt of energy, takes place in the *absence* of free oxygen, and therefore is *not* energized by the oxygen-dependent metabolic systems within the muscle. Examples: putting the shot, sprinting, swinging a golf club.

Anoxia - a condition in which the supply of oxygen is limited so severely or for so long a time that the affected cells, tissues, etc., are permanently damaged.

Anticoagulant - a substance that hinders or prevents clotting. When administered to persons in whom the normal flow of blood has been stopped at some point by a clot, the anticoagulant will prevent the formation of new clots and/or the enlargement of the existing one, but it usually won't dissolve the existing clot. Examples: heparin and coumarin derivatives.

Aorta - the main trunk artery which, through its many branches, distributes oxygenated blood to all parts of the body except the lungs (see diagram on p. 2). It rises from the left ventricle, arches over the heart like the handle of a cane, and passes down through the chest and abdomen in front of the spine.

Aortic valve - a valve at the juncture of the aorta and the left ventricle. Formed of three cup-shaped membranes (called *semilunar valves*), its functions are to (1) permit the flow of arterial blood from the left ventricle into the aorta and (2) prevent a backflow.

Arterial pulse - the regularly recurrent wave of distension in the arteries produced by the surge of blood sent through them at each contraction of the ventricles; the "beat" or throb of that wave that can be felt (sometimes seen) in a superficial artery (an artery near the skin, such as the radial and carotid arteries); the number of such beats in a specified period of time (usually one minute).

Arteries - tubular, branching vessels that carry blood away from the heart to various parts of the body. The arteries carry oxygenated blood — except for the pulmonary artery, which takes "venous" blood to the lungs for oxygenation. Because arterial blood flows in waves under pressure from the contraction of the ventricles, the walls of the arteries are thicker, more elastic, and more muscular than those of veins.

Arterioles - very small arteries (approximately 0.2 mm or 1/125 in. in diameter) which result from repeated branching of the arteries and which carry blood from the arteries to the capillary bed.

Arteriosclerosis - loss of elasticity in the arterial walls as a result of hardening and thickening brought about by old age and accelerated by concentrations of low density cholesterol.

Arteriovenous oxygen difference - a measure of the volume of oxygen used by the cells during physical activity performed at submaximal (usually 85 percent) to maximal heart rate levels.

Atherosclerosis - the premature onset of arteriosclerosis; a degenerative disease of the arteries characterized by the accumulation of lipids, complex carbohydrates, blood and blood products, fibrous tissue, calcium deposits, etc., in the inner layer of the arterial wall which thickens the wall, making it less able to respond to contraction from the ventricles, and narrows the vessel passage. Atherosclerosis is especially significant when it affects the coronary arteries (heart attack).

Atrium - the upper chamber on either side of the heart which receives the blood from the veins. The right atrium receives unoxygenated blood from the head and arms via the superior vena cava and from the trunk and legs via the inferior vena cava, and the left atrium receives oxygenated blood from the lungs via the pulmonary vein.

Auricle - the upper section on either side of the heart which receives the blood from the veins. Since the atrium is the main chamber of the auricle (see definition given above), the term *atrium* is more often used than *auricle*.

Auscultation - listening to and interpreting sounds within the heart, lungs, and other organs (usually with a stethoscope, but occasionally by directly applying the ear to the area) as an aid to diagnosis and treatment.

Barbiturates - any of a large group of slightly bitter crystalline acids or their salts derived from barbituric acid and used as sedatives, hypnotics, and antispasmodics. They affect the higher centers of the brain.

Blood pressure - the pressure of blood in the arteries. Usually measured on the radial artery in the upper arm by an instrument called a sphygmomanometer, it is expressed in millimeters of mercury (mmHg) either as a fraction (e.g., 120/80) or as a whole number (e.g., 120). The fraction is composed of the maximum pressure produced by the contraction of the ventricles (systolic pressure) over the minimum pressure resulting from the relaxation of the ventricles between heartbeats (diastolic pressure), and the whole number represents systolic pressure only. Blood pressure varies with the muscular efficiency of the heart, the volume and viscosity of the blood, the age of the individual, and the condition of the vascular wall. It tends to increase gradually with age and excessively with certain vascular kidney and endocrine disorders, and to decrease with hemorrhage, hypothyroidism, and various debilitating diseases.

Calorie - the amount of heat required at a pressure of one atmosphere to raise the temperature of one gram of water one degree Celsius, especially from 15° to 16°; a unit expressing the amount of heat or energy that foods and beverages will produce when oxidized in the body.

Calorigenic action - the total amount of heat or energy liberated by food or food constituents when metabolized by the body.

Capillaries - minute blood vessels connecting arterioles with venules or with the smallest of the lymph vessels to form a network or capillary "bed." They average 0.5 mm in length and are composed of a single layer of endothelial cells, through which oxygen and nutrients pass from the bloodstream into the tissues and carbon dioxide and other metabolic wastes move from the tissues into the blood.

Cardiac cycle - the complete sequence of events in a single heartbeat, from the stimulus provided by the pacemaker through contraction (systole) and relaxation (diastole) of the ventricles, which ordinarily takes about 0.85 of a second in human beings.

Cardiac failure - the condition in which the heart is no longer able to pump an adequate supply of blood in relation to the venous return and the metabolic needs of the body.

Cardiac output - the volume of blood ejected per minute by the left ventricle and expressed in liters.

Cardiac reserve - the ability of the heart to increase its output in response to increased demands.

Cardiovascular - of, relating to, or involving the heart and blood vessels, as *the cardiovascular system.*

Cardiovascular fitness - the general health and operational efficiency of the heart and blood vessels.

Cardiovascular function - the operation of the cardiovascular system; the process of circulating blood in order to carry oxygen and nutrients to the tissues and remove carbon dioxide and metabolic wastes from them.

Cardiovascular system - a closed circuit composed of the heart and blood vessels.

Carotid artery - the principal artery on either side of the neck that supplies blood to the head.

Cholesterol - a fat-soluble crystalline steroid alcohol ($C_{27}H_{45}OH$) that is an essential part of animal cells and body fluids. It is synthesized in the body, especially in the liver and the adrenal cortex, and plays an important role in physiological processes. For Americans, the normal level of cholesterol in the blood is assumed to be between 180 and 230 milligrams per 100 cubic centimeters. Higher levels, unless primarily composed of high density lipoproteins, often lead to atherosclerosis.

Coagulants - substances which cause the formation of clots by changing soluble proteins to cordlike, insoluble proteins by chemical reaction. For example, a coagulant such as the enzyme thrombin causes the formation of bloodclots by converting fibrinogen, a soluble protein of the globulin class found in plasma and other liquid components of blood, to fibrin, an elastic insoluble protein that forms a network of filaments in the blood that impedes and may ultimately stop its flow.

Coronary arteries - the two arteries which branch from the aorta (one on the right, the other on the left, immediately above the semilunar valves) and service the tissues of the heart itself.

Diastole - that part of the cardiac cycle when the heart muscle relaxes and the chambers fill with blood. *Auricular diastole* refers to the period when the atria fill with blood, and *ventricular diastole* refers to the period when the ventricles fill with blood.

Diastolic pressure - the lowest arterial blood pressure in the total heartbeat. It occurs during the diastolic or relaxation/filling phase of the cardiac cycle.

Dysrhythmias - disordered rhythms or irregularities in the heartbeat.

Electrolyte solutions - liquid forms of substances which, when dissolved in water or another solvent, are capable of conducting an electric current and are ionized (broken down into positively and negatively charged particles) by it. Examples: Gatorade, ERG. During prolonged physical workouts or competitions, electrolyte solutions help to maintain a relatively stable internal environment, especially in terms of body heat and blood volume/fluid balance.

Electron transport capacity - the ability of the cardiovascular system to carry out a process of biological oxidation in which electrons are transferred through a series of compounds (cytochromes) to oxygen, the energy of the process being conserved by the formation of high-energy bonds in the form of adenosine triphosphate (see definition given earlier).

Endocardium - the thin, smooth membrane that lines the interior of the heart.

Fibrinolytic capability - the ability to dissolve bloodclots by digesting or breaking down fibrin, the insoluble protein that forms the essential part of a clot.

Glycogen system - the anerobic (functioning in the absence of free oxygen) system which releases caloric energy for such activities as team games and middle-distance running by converting glycogen (also called *animal starch*), the principal form in which carbohydrate is stored in liver and muscle cells, into glucose (a sugar) through hydrolysis (decomposition by reaction with water).

Heart - a chambered, muscular organ in the cavity of the chest that functions as a pump in circulating blood through the 100,000 mile (160,000-kilometer) vascular pipeline that services all the cells of the body.

Heartbeat - the throb or pulsation that results from each contraction of the ventricles.

Heart rate - a measure of cardiac activity usually expressed as the number of beats (ventricular contractions) per minute.

Heart sounds - the sounds produced by the normal activity of the heart. They occur in cycles of four and can usually be heard through a stethoscope. The first and second sounds relate to the closing of the atrioventricular and semilunar valves, respectively; the third and fourth, which are much softer, even inaudible at times, relate to the filling of the ventricles and the contraction of the atria, respectively.

Hematology - the science of blood: its nature, formation, function, and diseases.

Hemoglobin - a protein pigment in red blood cells which contains iron, transports oxygen, and is responsible for the red color of fresh blood. Human hemoglobin consists of four *heme* molecules (iron-protoporphyrin) linked to a molecule of the protein *globin*, which is composed of complexly folded polypeptide chains and varies somewhat in different physiological, pathological, and genetic states. Produced by the red cells (which were produced by the marrow or center part of the bones), hemoglobin is formed from iron, vitamin B_{12} and other B vitamins, vitamin C, and certain proteins. It has the reversible property of combining with oxygen or releasing it, depending primarily on the oxygen tension of the medium surrounding it. At tensions of 100 mmHg or more (as in the lungs), hemoglobin is fully saturated with oxygen; but below that level, particularly at 50 mmHg or less (as in the body tissues), it releases progressively greater quantities of the oxygen it carries. Other factors which affect the dissociation of oxygen from oxyhemoglobin (H_bO_2 — the combination of oxygen and hemoglobin) are temperature, electrolytes, and carbon dioxide tension. There are also factors which affect the ability of hemoglobin to take up oxygen. Aerobic exercise increases it, but carbon monoxide, for which hemoglobin has a strong affinity, and aniline dyes and other chemicals that cause the oxidation of ferrous iron and convert hemoglobin to methemoglobin, a substance which cannot take up oxygen, preclude that ability. A shortage of hemoglobin or hereditary abnormalities in it may result in one of the less or more serious forms of anemia. The symbol for hemoglobin is H_b; its average molecular weight is 67,000; and its concentration in human blood is 14 to 16 grams per milliliter.

High blood pressure - persistent elevation of the blood pressure which may result in an enlarged heart, weakened or ruptured arteries, or damage to such organs as the kidneys. Eighty-five percent of the essential high blood pressure cases are ideopathic (i.e., without apparent or determinable cause), but may relate to hereditary tendency, emotional tensions, faulty nutrition, or hormonal influence. The remaining 15 percent of the cases seem to be caused by or are otherwise secondary to demonstrable organic changes in the tissues, such as obesity, nephritis, diabetes, arteriosclerosis, tumors in the adrenal glands, hyperthyroidism, etc.

Hypertension - a condition marked by persistently high levels of tension or stress; until recently, considered a synonym for high blood pressure.

Inferior vena cava - a vein formed by the junction of the two common iliac veins. It receives blood from the lumbar, right spermatic, renal, right suprarenal, phrenic, and hepatic veins and empties it into the right atrium of the heart.

Lactic acid - a hygroscopic (readily absorbing moisture) usually syrupy acid that occurs in three forms, one of which is normally present in blood and muscle tissue as a product of the anerobic metabolism of glycogen; also called *sarcolactic acid*.

Lipoprotein - a component of cholesterol consisting of a simple protein combined with a lipid and classified according to density and the ratio of protein to lipid in its composition. High-density lipoproteins with more protein than lipid are called *alpha* lipoproteins and considered beneficial to cardiovascular health; those with low density and less protein than lipid are called *beta* lipoproteins and are not beneficial; and those containing the largest amount of lipid are called *omega* lipoproteins and appear primarily as microscopic particles of fat in the blood during the digestion and assimilation of fatty foods.

Maximal oxygen uptake - the volume of oxygen used by the cells during physical activity at maximal heart rate levels.

Metabolism - the sum of the processes involved in the chemical conversion of (1) nutrients into complex living matter (assimilation, anabolism) for the growth and repair of tissues and (2) complex substances into simple ones (disassimilation, catabolism) for the production of energy to be used in vital processes and activities.

Mitral valve - a valve consisting of two triangular flaps that prevents the blood in the left ventricle from flowing backward into the left atrium. Also called the *bicuspid valve*, the *left atrioventricular valve*, and the *valva atrioventricularis sinistra*.

Myocardium - the muscular tissue of the heart. The thickest of the three layers of the heart wall, it lies between the inner layer (endocardium) and the outer layer (epicardium).

Myoglobin - the form of hemoglobin that occurs in muscle fibers. It differs from blood hemoglobin in the globin portion of its molecule, having a greater tendency to combine with oxygen, a smaller Bohr effect (the influence of carbon dioxide upon the dissociation of oxygen from hemoglobin and some related compounds), a lower affinity for carbon monoxide, and a lower molecular weight. It serves as a short-term oxygen store, carrying the muscle from one contraction to the next. Also called *myohemoglobin*.

Nutrition - the sum of the processes by which a living organism receives and uses the food substances which maintain its functions and the growth and renewal of its parts — ingestion, digestion, absorption, and assimilation.

Obesity - a condition marked by excessive accumulations of fat and a resultant body weight which is 10 to 20 percent beyond the normal range for the person's age, sex, and height.

Overload principle - the concept that, in order to improve cardiovascular health and performance, physical activity should be vigorous enough to accelerate the heart rate beyond an individually predetermined threshold level (see Karvonen Training Stimulus Formula on p. 16) and of sufficient duration to maintain that rate within a limited range for a specified period of time, usually 15 to 20 minutes.

Palpation - pressing the hand or fingers to the surface of the body in order to determine characteristics and conditions of the local tissues or underlying parts or organs.

Percussion - tapping the surface of the body with a finger or a small hammer in order to elicit sounds or vibratory sensations as an aid in diagnosing the condition of the parts beneath. Compare *auscultation*.

Pericardium - the protective membranous sac that encloses the heart and the roots of the great vessels. Its base is attached to the central tendon of the diaphragm. The part in contact with the heart is called the *visceral pericardium* or *epicardium*, and the other is called the *parietal pericardium*. The sac normally contains between 5 and 20 grams of clear serous liquid that minimizes and absorbs the friction engendered by the "beating" of the heart.

Phosphocreatine (PC) - a phosphoric acid derivative of creatine which contains an energy-rich phosphate bond and is present in muscle and other tissues. During the anerobic phase of muscular contraction, it hydrolyzes to creatine and phosphate, releasing energy for the contractile process.

Post-exercise recovery heart rates - the number of times the heart beats per minute immediately after and/or 5 minutes after exercise. Usually counted at the carotid artery (unless electrographic equipment is being used), post-exercise recovery heart rates are practical indicators of cardiovascular health for, in general, the more rapidly they return from levels stimulated by exercise to normal resting heart rate levels, the greater the degree of cardiovascular health.

Pulmonary artery - the large artery that conveys unoxygenated (venous) blood from the right ventricle to the lungs. It runs upward and backward from the right ventricle and divides into the right pulmonary artery (which passes under the arch of the aorta and goes to the right lung) and the left pulmonary artery (which goes to the left lung with further division into branches that accompany the bronchial tubes). The pulmonary artery is the only artery which carries unoxygenated blood, all others carrying oxygenated blood to the various parts of the body.

Pulmonary circuit - that part of the vascular system which carries venous blood from the right auricle through the right ventricle to the lungs for oxygenation and purification and back to the left atrium for circulation to all other parts of the body via the systemic circuit.

Pulmonary vein - one of a set of four valveless veins (two from each lung) that carry oxygenated blood from the lungs to the left atrium of the heart.

Pulse rate - the number of pulsations of an artery per minute. Since each pulsation is caused by the surge of blood produced by a contraction of the ventricles, pulse rate reflects heart rate and is one of the most practical ways of assessing cardiovascular health. It is usually counted at the carotid artery in the throat or the radial artery at the wrist, and is expressed in beats per minute.

Radial pulse - the throb or pulsation of the radial artery, particularly as felt at the wrist near the base of the thumb.

Semilunar valves - regulated openings which consist of cup-shaped flaps that prevent the backflow of blood. The aortic valve between the left ventricle and the aorta, and the pulmonary valve between the right ventricle and the pulmonary artery are semilunar valves. Forced apart by pressure in the ventricles during systole and pushed together by pressure in the arteries during diastole, they prevent the blood from returning to the ventricles.

Septum - a muscular partition or dividing wall. The *atrial* or *inter-atrial septum* separates the left atrium from the right, and the thicker *ventricular* or *inter-ventricular septum* separates the two ventricles of the heart.

Sphygmomanometer - an instrument for measuring blood pressure in the arteries.

Stethoscope - an instrument for detecting sounds within the body, especially in the chest or abdomen. The sounds are conveyed to both ears of the examiner through rubber tubing which connects a pair of earpieces to an endpiece placed upon the surface of the body over the area to be examined.

Stroke volume - the amount of blood ejected from the left ventricle at each contraction.

Superior vena cava - the vein formed by the union of the brachiocephalic veins (in the arms and head) which carries venous blood from the head, the chest wall, and the upper extremities to the right atrium of the heart.

Systemic circuit - that part of the cardiovascular system which carries blood from the left auricle through the left ventricle to all parts of the body (except the lungs) and back to the heart, where it connects with the pulmonary circuit via the right atrium.

Systole - the period of contraction which forces the blood through the circulatory system and produces the heartbeat. *Atrial systole* is the period when the upper chambers contract, and *ventricular systole* is the period when the ventricles contract.

Systolic pressure - maximum blood pressure during ventricular contraction.

Training stimulus - the suggested optimal heart rate for improving and/or maintaining cardiovascular fitness. It lies between the minimum and maximum heart rates at which a given individual can safely exercise and still achieve a positive cardiovascular effect. (See Karvonen Training Stimulus Formula on p. 16).

Tricuspid valve - a valve consisting of three cusps or triangular flaps that permits the flow of blood from the right atrium to the right ventricle and prevents a backflow. Also called the *right atrioventricular valve* or the *valva atrioventricularis dextra*, the tricuspid valve corresponds to the bicuspid or mitral valve in the left side of the heart.

Vasoconstrictor - a chemical agent which, by stimulating the vasoconstrictor nerves of the involuntary nervous system, brings about a constriction or functional narrowing of the blood vessels which, in turn, increases resistance to the flow of blood and elevates the blood pressure. Examples: adrenaline, epinephrine.

Vasodilator - a chemical agent which, by stimulating the vasodilator nerves of the involuntary nervous system, brings about a dilation of the blood vessels and a resultant enlargement or functional widening of the vessel passages which, in turn, reduces resistance to the flow of blood and lowers the blood pressure. Examples: nitroglycerine, nitrites, thiocyanate.

Veins - blood vessels which carry unoxygenated blood filled with metabolic wastes from the tissues to the heart. Like arteries they consist of three coats or layers, but since the media, which contains muscle cells, is less well developed in veins than in arteries, the vessel walls are thinner and many have valves to prevent a backflow of blood in the absence of strong pulsation and muscular support.

Ventricle - one of the two lower chambers of the heart. The *left ventricle* receives oxygenated blood from the left atrium and pumps it through the systemic circuit to all parts of the body except the lungs. The *right ventricle* receives unoxygenated blood filled with metabolic wastes and pumps it through the pulmonary circuit to the alveoli in the lungs.

Venules - tiny veins which connect the capillary bed with the larger systemic veins.

Workload performance tests - quantifiable methods of measuring cardiovascular health or the system's ability to cope with stress produced by physical activity. Examples: bicycle ergometer or treadmill tests, graded exercise tolerance tests, step tests, and various walk/run tests.

The Problem of Cardiovascular Disease

Normal Artery

Fatty Deposits in Vessel Walls

Plugged Artery with Fatty Deposits and Clot

A heart attack victim treated by an emergency rescue service (ERS) has an increased chance of reaching the hospital alive and surviving the ordeal.

220

221

FIND THE TERMS

The following puzzle contains 46 words and phrases related to cardiovascular health. Circle the terms you find printed in any one or a combination of directions: *horizontally* - from left to right and from right to left; *vertically* - from top to bottom and the reverse; and *diagonally* - from lower left to upper right, from upper right to lower left, from lower right to upper left, and from upper left to lower right. The terms in the puzzle are listed alphabetically at the bottom right of this page.

A U R I C L E K A S E L O I R E T R A W Z
N D E T U P T U O C A I D R A C E A I O E
T O E K A T P U N E G Y X O L A M I X A M
I Q U N L N O I T I R T U N M L L W O N U
C S T R O K E V O L U M E P A O A R N B T
O E W A C S A M S A L P H E A R T R A N P
A L V E O L I E U T O E H T A I T R M N E
G E E R O O O N A R T E R Y C E B R Y A S
U P N O A R U T E A W O C V K I B P O L A
L O T B A E L R M T A L A C T I C A C I D
A C R I A T R I U M R L W U M Q U L A P I
N S I C U S N J C W V I R N B Z H P R O P
T O C Y S E L U N E V A P U L S E A D P O
F H L T S L T Z A U T Q A H O N T T I R S
I T E I W O G N L E F O N M O J A I U O E
B E E S N H S Y S T O L E N D S R O M T T
R T N E O C A P I L L A R I E S P N X E I
I S J B K N X G Y G O L O T A M E H A I S
N I B O L G O Y M E T A B O L I S M A N S
A N G I N A E V L A V D I P S U C I R T U
L G O F D I A S T O L I C P R E S S U R E

222

1. Adenosine triphosphate
2. Adipose tissue
3. Aerobic
4. Alveoli
5. Amphetamines
6. Anerobic
7. Angina
8. Anoxia
9. Anticoagulant
10. Aorta
11. Aortic valve
12. Arterioles
13. Artery
14. Atrium
15. Auricle
16. Barbiturates
17. Blood
18. Calorie
19. Capillaries
20. Cardiac output
21. Cholesterol
22. Clot
23. Diastolic pressure
24. EKG
25. Fibrin
26. Heart
27. Hematology
28. Lactic acid
29. Lipoprotein
30. Maximal oxygen uptake
31. Metabolism
32. Myocardium
33. Myoglobin
34. Nutrition
35. Obesity
36. Palpation
37. Plasma
38. Pulse rate
39. Septum
40. Stethoscope
41. Stroke volume
42. Systole
43. Tricuspid valve
44. Veins
45. Ventricle
46. Venules

223

A Selective Multimedia Resource Listing

Alcohol: Facts, Myths and Decisions. #229-14, a 3-part filmstrip program. Sunburst Color Sound Filmstrips, 41 Washington Avenue, Pleasantville, NY 40570. 1976.

A 3-part filmstrip program intended to expose popular misconceptions about alcohol, examine alternative behaviors in simulated social situations where the use of alcohol creates problems, explain how alcohol affects the body, identify the warning signs of incipient alcoholism, and cite sources of help for teenage problem drinkers and their families and for children and youth who must cope with alcoholic parents.

American Alliance for Health, Physical Education and Recreation. 1201 16th Street, N.W., Washington, DC 20036. *Knowledge and understanding in physical education;* rev. ed. 1973.

A manual for teachers which presents the cognitive aspects of physical education. It contains a course of instruction in concepts and knowledges which are basic to meeting all of the objectives of the program. Stress is placed on the *why* as well as the *how* of exercise. Test items are included.

_____. *Youth fitness test manual,* by Paul Hunsicker and Guy Reif. 1976.

American Automobile Association. Traffic Education Resources. *Al-co-hol: an alcohol awareness program for junior high schools,* by James L. Malfetti, Kenneth J. Simon, and Monica M. Homer. 1978.

A 3-part package of instructional materials consisting of a teacher's guide; an 11-minute, semianimated color film for loan (without charge) or purchase; and a boxed packet containing two 17 x 22 display charts, a 4-color transparency, games, puzzles, role-playing simulations, take-home assignments, and all tests and answer-sheet overlays for five complete lessons. Developed and field-tested as a Safety Research and Education Project conducted through Teachers College of Columbia University with funding from the American Automobile Association's Foundation for Traffic Safety, the materials are available from local AAA clubs as a traffic safety service.

American College of Cardiology. Heart House Learning Center, 9650 Rockville Pike, Bethesda, MD 20014.

A valuable source of information about the cardiovascular system and the things that affect it.

American Heart Association. *A guide to grade level placement of materials for instruction on the heart and circulatory system.*

A catalog of publications, exhibits, posters, slides, and films arranged according to topic and recommended for use at one or more of the following levels of instruction: 4-6, 7-8, 9-12, and college or adult. Includes background information and visual aids "especially for teachers."

_____. *Beyond diet: exercise your way to fitness and heart health,* by Lenore R. Zohman, M.D. 1974.

A guide to developing personal exercise programs based on the principles of exercise endorsed by the American Heart Association and the President's Council on Physical Fitness and Sports. Made available through local chapters of the AHA as a public service by Mazola Corn Oil, a unit of Best Foods, CPC International, Inc.

_____. *Professional and public educational films.*

A fully annotated catalog of educational films available for rental and/or purchase through local chapters of the American Heart Association. Sample titles include *Barney Butt; CPR - For the Sake of Life; Circulation and the Human Body; Eat to Your Heart's Content; The Heart that Changed Color; Heartman; High Blood Pressure: If Only It Hurt a Little; Highway to Healthy Hearts: Journey into Nutrition; Run Dick, Run Jane;* and *The Way to a Man's Heart.* Annotations include suggested audiences.

_____. *Recommendations for human blood pressure determination by sphygmomanometers,* by Walter M. Kirkendall, M.D.; Alan C. Burton; Frederick H. Epstein, M.D.; and Edward D. Freis, M.D. 1967.

An authoritative booklet on equipment, techniques, and special considerations relative to measuring blood pressure with a sphygmomanometer and stethoscope. It includes a brief section on determining blood pressure in infants and children.

_____ - **New York State Affiliate.** Committee on Cardiovascular Disease in the Young, 3 West 29th Street, New York, NY 10001.

The American Red Cross. *The super cell twins.* Teacher's manual/12 slides/25 32-page pupil pamphlets. 1979.

A 3-part package designed for use as a science and/or supplementary reading unit with pupils at second-grade reading and comprehension levels. The material presents information about blood components through the personalities of super cell twins Rich Red and Wonder White.

_____. *The history of hemotose.* Teacher's manual/12 slides/25 32-page pupil pamphlets. 1979.

A 3-part package designed for use as a science and/or supplementary reading unit with pupils at fourth-grade reading and comprehension levels. The material presents the story of blood through an outer space reporter who describes what blood is, how it is used, and how people share it.

_____. *Blood: the river of life,* by Donald R. Avoy, M.D. 1967.

A readable compilation of "the basic biological information required to understand the properties of blood, its uses in the treatment of diseases, and its uniqueness as a medicine." Contains 11 full-color illustrations of blood cells, 14 diagrams, a glossary of terms, and a series of study questions which deal with such topics as the composition of blood, the operation of the cardiovascular system, the process and implications of the human being's ability to develop immunities, the nature of various blood diseases (including those which affect the newborn), and the collection, storage, and use of blood to cure or mitigate the effects of these diseases. Available without charge in classroom sets from regional offices of the Red Cross.

_____. *Blood: this wonder of life.* 1974.

A manual of suggested activities to help elementary school children to understand the nature and function of blood and to develop positive attitudes toward donating blood. Includes a matching game, two plays, and a series of ideas for things children can make, see, discuss, etc.

Anatomy Charts. 41583 - *Circulatory system.* 41584 - *Scheme of circulation, portal circulation and capillaries.* 41585 - *Chest cavity and heart.* 42" (106.5 cm.) x 66" (167.5 cm.). Denoyer-Geppert, 5235 Ravenswood Avenue, Chicago, IL 60640.

Edited by Otto F. Kampmeier of the University of Illinois College of Medicine, Harold C. Voris, professor of neurosurgery at Loyola University, and personnel from the German Health Museum, the charts are lithographed in seven colors, producing a 3-dimensional effect. Display mountings and smaller charts are also available.

"Applied Physiology of Exercise: A Biological Awareness Concept," by D. W. Edington and L. Cunningham. *Journal of Health, Physical Education and Recreation.* October 1973. pp. 30-31.

Asserts that exercise physiology should be an integral part of physical education at every level, including the elementary, and therefore contains examples of mini-lessons for elementary school children on "biological awareness" or "becoming aware of one's body and how it responds to exercise."

Artery Specimen. HE-1029. Spenco Medical Corporation, P.O. Box 8113, Waco, TX 76710.

Permanently mounted sections of preserved arterial tissue showing the effects of atherosclerosis. Includes normal as well as moderately and severely atherosclerotic conditions, and clearly reveals buildups and clogging by cholesterol. A full-color brochure showing inside photos of arteries, clotting, and heart damage comes with the specimen, and a descriptive explanation is separately encased and framed with the tissue.

The Berkeley Project. *Your body systems and you: function, operation, and protection.* "The Circulatory System" - Grade 6. National Center for Health Education, 211 Sutter Street, San Francisco, CA 94108.

Since this is a nationally validated project, school personnel can apply for ESEA Title IV-C replication funds to incorporate it into their ongoing health and/or physical education programs.

Billboard Smoking Machines. HE-1026B "Tarayton Smoker" (boy) w/lesson guide. HE-1026G "Salum Smoker" (girl) w/lesson guide. Spenco Medical Corporation, P.O. Box 8113, Waco, TX 76710.
"Machines with personality" that inhale the smoke from cigarettes and collect the tars in transparent lung cavities.

Blood Circulation Demonstrator. 70707. Denoyer-Geppert, 5235 Ravenswood Avenue, Chicago, IL 60640.
A complete illustration of the human body on plexiglass mounted in a lightweight metal frame and illuminated from behind. Operated by either a manual or a motor-driven pump, the model demonstrates the pumping action of the heart, the flow of blood through the body, and the functional characteristics of systemic (body) amd pulmonary circulations. Section drawings at the foot of the model are supplementary.

Blood Coagulation Series. 4 Super-8 silent film loops. *Observing clot formations. Origin of the platelets in human blood. Formation of fibrin. Dissolving blood clots.* Prod. by Sakura Motion Picture Company, Ltd. Dist. by BFA Educational Media, 2211 Michigan Avenue, Santa Monica, CA 90404.
The process of blood coagulation, the breaking up of platelets, the formation of fibrin, and the way in which plasmin helps to dissolve a blood clot are shown through unique sequences in cinemicroscopy and slow-motion and time-lapse photography.

Blood Pressure Levels of Children 6-11 Years: Relationship to Age, Sex, Race, and Socioeconomic Status, United States. DHEW Publication No. (HRA) 74-1617. Data from the National Health Survey. Vital and Health Statistics — Series 11, No. 135. Rockville, Maryland: Health Resources Administration, National Center for Health Statistics, U.S. Department of Health, Education, and Welfare, Public Health Service, 1973.
Blood pressure measurements of children 6-11 years of age in the United States between 1963 and 1965, presented and discussed by age, sex, race, and socioeconomic status.

Blue Cross Association. 840 North Lake Shore Drive, Chicago IL 60611. *Blue print for health: food fitness.* 1973.
A unique collection of articles on nutrition, exercise, physical fitness, and motivation by such well-known experts in their respective fields as Jean Mayer, Bud Wilkinson, Joyce Brothers, Art Buchwald, James Lovell, and Esther Peterson. The publication is based on the belief that "no health care system can be successful if its goal is to 'give' or 'bring' health to the American people. The people whose health is involved must meet the system at least half way, which means they must learn to take better care of themselves -- not just to avoid illness, but to be able to function at their full capacity."

_____. *Blue print for health: help yourself.* 1978.
Another in a series of "blueprints for health," this collection of articles is "designed to produce surprising evidence that much if not most modern disease is to some degree preventable; to share the latest and best information about good diet, exercise and other ways of keeping well; and to describe some of the interesting new directions in self-help toward better health." Includes such titles as "How To Live With Stress," "We Can Guard Against Cancer," "Analyze Your Life-Style," "A 'Doctor' in Every Home," and "Treating the Whole Person."

Bowerman, W. J. and W. E. Harris, M.D. *Jogging.* New York: Grosset and Dunlap, Inc., 1967.
Written by a track coach at the University of Oregon and a medical doctor, this little booklet tells the what, the why, the how, and the when about jogging. Excellent for beginners as well as for experienced joggers.

Cardiovascular System and Exercise. A slide/tape module developed by William J. Tomik, professor of physical education, and available from the Sperry Learning Resource Center, State University College at Cortland, Cortland, NY 13045.

Cooper, Kenneth H., M.D. *Aerobics.* New York: Bantam Books, 1968.

_____. *The aerobics way: new data on the world's most popular exercise program.* Philadelphia: M. Evans and Company, Inc., 1977.

_____. *The new aerobics.* New York: Bantam Books, 1970.

_____ and Mildred Cooper. *Aerobics for women.* New York: Bantam Books, 1972.

Coping with Life on the Run. 30 min. color. 16 mm. Sports Productions, Inc., Box 296, Locust, NJ 07760.

Corbin, Charles and Ruth Lindsey. *Physical education concepts: fitness for life.* Glenview, IL: Scott, Foresman and Company, 1979.
A student worktext designed to enable students to determine their own fitness levels, needs, and programs. The teacher's edition includes sample infusion, module or unit, and "mini-plan" schedules; copy masters for a variety of forms and tests; and teaching outlines for programs and activities related to cardiovascular fitness, strength, muscular endurance, flexibility, fat control, good health, and skill development.

Coronary Care. HE-1056, a 24" (60.9 cm.) x 26" (66 cm.) x 12" (30.5 cm.) display plus 100 mini-texts. Spenco Medical Corporation, P.O. Box 8113, Waco, TX 76710.
A mode for estimating the chances of suffering a heart attack or stroke in which the "players" analyze their personal health characteristics and then move a series of rings, each representing a year of life, from 10 short poles representing coronary risk factors to a tall "longevity" pole in the center of the display. The risk factors include sex, family history, diabetes, excess weight, smoking, exercise, stress, personality type, cholesterol level, and high blood pressure.

Coronary Counter Attack. 20 min. color. 16 mm. Brigham Young University, Department of Motion Picture Productions, Provo, UT 84602.
In this sequel to *Run Dick, Run Jane* (another Brigham Young University film, this one available through local chapters of the American Heart Association), Dr. Kenneth H. Cooper again discusses the need for regular aerobic exercise to maintain high fitness levels and heart disease prevention.

CPR: How To Save a Life. #243-14, a 3-part program. Sunburst Color Sound Filmstrips, 41 Washington Avenue, Pleasantville, NY 10570. 1977.
The stated objectives for this 3-part sound-and-color filmstrip program are to (1) explain the importance of cardiopulmonary resuscitation (CPR) in saving lives and preventing brain damage, (2) develop an understanding of the early warning signs of heart attack, (3) teach the basic skills of CPR, and (4) encourage the viewers to become certified CPR rescuers through participation in authorized training programs for that purpose.

Cundiff, D.E. *Fundamentals of functional fitness.* Dubuque, IA: Kendall/Hunt Publishing Company, 1974.
A comprehensive treatment of physical fitness which includes an excellent description of the cardiopulmonary system, complete with diagrams and illustrations, and tests for evaluating cardiovascular health.

Drug Abuse Display. HE-1012, a 24" (60.9 cm.) x 24" (60.9 cm.) x 3/4" (1.9 cm.) display plus 100 drug abuse mini-texts. Spenco Medical Corporation, P.O. Box 8113, Waco, TX 76710.
A collection of exact facsimiles of 33 drugs permanently sealed and framed in plexiglas with classification, prescription name, slang name(s), medical uses, legal sources, and symptoms of abusers included for each drug.

Dudley. 8681, a 3-foot (0.9-meter) model of a male torso with 5 functioning body systems and a 76-page teacher's guide. Hubbard, P.O. Box 104, 1946 Raymond Drive, Northbrook, IL 60062.
A plastic model of a male human body from head to thighs with five functioning body systems housed in the cavity: the circulatory system, the digestive system, the nervous system, the respiratory system, and the urinary system. The circulatory system includes a flexible heart that, when squeezed, pumps "blood" through simulated arteries and veins, thus relating heart action to pulse.

Elementary Aerobic Dancing for Physical Education, by Jacki Sorensen. KEA 1126, 2 LP records and a manual. Educational Activities, Inc., P. O. Box 392, Freeport, NY 11520.
A vigorous exercise program designed to improve cardiovascular health while toning skeletal muscles and developing motor skills. Musical selections especially arranged for aerobic dancing include the themes from *Laverne and Shirley, Happy Days,* and *Star Wars; The Hustle; Jump, Shout Boogie;* and *Love Will Keep Us Together.* All routines, the narration, and the manual have been prepared for use with elementary school children. Secondary level routines are available on KEA 1125, with appropriate narration and manual.

Everyone's a Winner. A 4-part film series produced by Educational Communication Services, Department of Education, San Diego County, California. 16 mm. Dist. by BFA Educational Media, 2211 Michigan Avenue, P.O. Box 1795, Santa Monica, CA 90406.
Presents the basic elements of the President's program for physical fitness to intermediate and junior high school students through four 16 mm. films available individually and in series: #11631 *Everyone's a Winner: Heart-Lung Endurance* (15 min., color); #11629 *Everyone's a Winner: Muscular Strength and Endurance* (16 min., color); #11630 *Everyone's a Winner: A Program for Physical Fitness* (15 1/2 min., color); and *Everyone's a Winner: Balance, Flexibility and Power* (13 1/2 min., color).

Exercise and the Heart: Guidelines for Exercise Programs. Ed. by Robert L. Morse et al. Springfield, IL: Charles C. Thomas, Publisher, 1974.

Exercise in Cardiovascular Health and Disease. Ed. by Ezra A. Amsterdam et al. New York: Yorke Medical Books, 1977.

Exercise Testing and Exercise Training in Coronary Heart Disease. Ed. by John Naughton and Herman K. Hellerstein. New York: Academic Press, Inc., 1973.

A Fitness Experience: Continuous Rhythmic Movement for Classroom Fun'n Fitness, by Jacki Sorensen, KEA 1110, 2 LP records and a manual. Educational Activities, Inc., P. O. Box 392, Freeport, NY 11520.
A vigorous exercise program consisting of calisthenics and jogging routines set to the music of *The Lees of Virginia; Before the Parade Passes By; What's New, Charleston; Imagine;* and *Brian's Song.* Designed for use in grades 4-8.

Food: Health and Diet. #231-14, a 2-part filmstrip program. Sunburst Color Sound Filmstrips, 41 Washington Avenue, Pleasantville, NY 10570. 1976.
Designed for teenagers, this 2-part filmstrip program (1) examines the nutritional needs of the human body and the relationships between overweight parents and overweight children, (2) distinguishes fact from fallacy with regard to nutrition, and (3) outlines sensible approaches to dieting, including the role of exercise. Contains actual case studies.

4-Minute Exercises for Physical Fitness from the People's Republic of China, by Judy Job Callahan and Rosemary Hallum. AR 582, LP record plus 2 posters and a guide. AC 582, cassette plus 2 posters and a guide. Educational Activities, Inc., P. O. Box 392, Freeport, NY 11520.
A series of 8 complete exercises developed by the Chinese Physical Culture Institute and set to music performed by the National Symphony Orchestra of China. Two posters illustrate the exercises and the record/cassette provides the music, spoken directions for doing the routines, and voice cues with the music.

A Handbook of Heart Terms. Public Health Service Publication No. 1073. Prepared by the Heart Information Center, National Heart Institute, Bethesda, Maryland and available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.
A glossary of terms frequently used in dealing with cardiovascular health, but possibly unfamiliar to nonspecialists in the field. Drawn from medicine, anatomy, physiology, instrumentation, pharmacology, and related professions, the terms are listed alphabetically and followed by phonetic spellings, definitions, and illustrations when needed for clarity.

The Health Letter.. Ed. by Lawrence E. Lamb, M.D. P.O. Box 326, San Antonio, TX 78292.

The Heart: Counter Attack. 25 min. sd. color. 16 mm. CRM Educational Films, Del Mar, CA 92014. 1972.

Hockey, R.V. *Physical fitness: the pathway to healthful living.* St. Louis, MO: C.V. Mosby Company, 1973.
An excellent review of cardiovascular function, the effects of exercise on the system, and laboratory-type activities for assessing fitness.

How To Stop Smoking. #238-14, a 2-part filmstrip program. Sunburst Color Sound Filmstrips, 41 Washington Avenue, Pleasantville, NY 10570. 1977.
Designed specifically for teenagers who want to stop smoking, this 2-part program explores various motivations for smoking, suggests ways of dealing with them, and then presents six proven methods to stop smoking.

Human Body - Study Unit. 2001, complete unit. 2006, male torso model plus lesson plan. 1580, 12 full-color transparencies. 706, 6 color/sound filmstrips. Hubbard, P. O. Box 104, 1946 Raymond Drive, Northbrook, IL 60062.

"Tommy," a fully developed male torso model 12" (30.5 cm.) x 27" (68.6 cm.) in size with a clear plastic overlay, demonstrates how body systems work both separately and together. The transparencies present basic information about the body and the structure and function of its parts, and the filmstrips show how the body works in an ever-changing environment.

_____ - Systems of the Human Body: Heart. 2 Super 8 mm. filmloops. 9779, set of 2 with lesson plans. 9780, *Pulmonary circulation* plus study guide. 9781, *Circulation within the body* plus study guide. Hubbard, P. O. Box 104, 1946 Raymond Drive, Northbrook, IL 60062.

Two color filmloops, one showing pulmonary circulation and the other, systemic circulation — each with accompanying study guide. Available separately and as a set.

I Am Joe's Heart. 26 min. color. 16 mm. Pyramid Films, P.O. Box 1048, Santa Monica, CA 90406.

Live color sequences plus 3-dimensional color animation demonstrate the structure and operation of the heart. Emphasis is placed on diet, exercise, and avoidance of smoking as ways to prevent heart attacks.

Johnson, P. B., W. F. Updyke, M. Schaefer, and D. C. Stolberg. *Sport, exercise, and you.* New York: Holt, Rinehart and Winston, Inc., 1975.

Written for college students, this is a comprehensive treatment of all aspects of exercise and fitness. Includes chapters on the cardiovascular system, the benefits of exercise, and techniques for evaluating fitness. Well illustrated with tables and graphs.

Kasch, F. and J. L. Boyer. *Adult fitness: principles and practice.* Palo Alto, CA: National Adult Press, 1968.

One of the first and still one of the best paperbacks on fitness for laymen and professionals alike. Concise and authoritative.

Keeping Fit. An individualized science instruction system. Ginn and Company, 191 Spring Street, Lexington, MA 02173.

Kuntzleman, C. T. *Fitness discovery activities.* Spring Arbor, MI: Fitness Finders, 1976.

Published for the National Council of YMCA's and the Nationwide YMCA Cardiovascular Health Program, the publication contains a series of "laboratory" activities related to five major concepts: fitness, cardiovascular system and coronary risk factors, body weight and composition, nutrition, and stress. The material ranges from elementary school through adult in level of appropriateness and includes such activities as the aerobic fitness finder test, tracing the blood flow, taking pulse and blood pressure readings, estimating the number of calories used per day, and making peanut butter.

The Mechanical Smoker. HE-1024, mechanical smoker plus 100 mini-lungs and a lesson guide. HE-1024, mini-lung refill packet. Spenco Medical Corporation, P.O. Box 8113, Waco, TX 76710.

An inexpensive teaching device with a one-way valve in the head which channels smoke from a lighted cigarette into a clear plastic mini-lung.

Metropolitan Life Insurance Company. *Catalog: health and safety educational materials.* Health and Safety Education Division, Metropolitan Life Insurance Company, 1 Madison Avenue, New York, NY 10010.

A catalog of multimedia educational materials available from the Metropolitan Life Insurance Company, many without charge. Includes such items as Metropolitan Life's Four Steps to Weight Control, which contains nutrition information, low-calorie menus, calorie tables, and a desirable weights chart; a personal health record folder; and an Early Warnings of a Heart Attack Card, which not only describes early signals of a possible heart attack but also suggests ways of helping a heart attack victim.

Meyers, E. J. "Exercise physiology in secondary schools: a three-dimensional approach." *Journal of Health, Physical Education and Recreation.* January 1975.

Describes the program at Penney High School in East Hartford, Connecticut, which consists of three levels: (1) an indepth elective course in exercise physiology open to juniors and seniors who have passed biology; (2) large group, lecture-type instruction which focuses on a cognitive approach to understanding concepts of physical activity; and (3) the regular program in physical education. Includes examples at each level.

Mitchell, Curtis. *The perfect exercise.* New York: Simon and Schuster, Inc., 1976.
A guide to rope-jumping for health and fitness.

Multi-media Heart Kit. 70140. Denoyer-Geppert, 5235 Ravenswood Avenue, Chicago, IL 60640.
Endorsed for study by the American Heart Association, the heart model in this kit measures 6" (15.2 cm.) x 9" (22.9 cm.) x 15" (38.1 cm.); is made of unbreakable plastic; features flexible chordae tendinae and cusps which permit readily observable demonstrations of valve action; and has three access flaps for interior views. The kit also contains a filmstrip with an accompanying guide which covers each frame; a record (or cassette) which provides a voice guide through the model's basic workings and relationships; a classpack of student study sheets, with two keys; and a 8-page illustrated resource manual of related activities for classroom and laboratory.

National Dairy Council and its local/regional affiliates in New York State. National Dairy Council, 6300 North River Road, Rosemont, IL 60018. Dairy, Food and Nutrition Council, Inc., 172 Halsted Street, East Orange, NJ 07018; 834 Front Street, Binghamton, NY 13905; Commerce Building, 678 Troy-Schenectady Road, Latham, NY 12110; Executive Professional Building, 201 South Avenue, Poughkeepsie, NY 12601; and 840 James Street, Syracuse, NY 13203. Dairy Council of Metropolitan New York, Inc., 60 East 42nd Street, Room 1235, New York, NY 10017. Dairy Council of Niagara Frontier Area, 2451 Wehrle Drive, Buffalo, NY 14221. Dairy Council Rochester Area, Inc., 73 Halstead Street, Rochester, NY 14610.
Provides consultation in nutrition education, continuing education workshops in nutrition, suggestions for integrating nutrition education into various curriculum areas, assistance in organizing nutrition education programs, instructional materials, and demonstrations or orientation workshops in the use of the materials.

_____. *Coronary heart disease: risk factors and the diet debate,* by Laurence M. Hursh, M.D. 1969.
A brief but informative discussion of various aspects of coronary heart disease, the major risk factors affecting it, and the significance of diet to it conducted by a physician with wide experience in medical research and nutrition.

_____. *Focus on health and nutrition: a health education guide for high school teachers,* by Robert H. Kirk and Michael H. Hamrick. 1977.
A comprehensive health education curriculum guide for grades 9-12, which "focuses" on nutrition, mental health, diseases, personal health care, family life education, substances harmful to health, consumer health, environmental health, safety and accident prevention, and community health. Each unit consists of concepts and behaviorally stated objectives supported by suggested content, teaching-learning experiences, references and resources, and evaluation activities.

_____. *Food...your choice: a nutrition learning system.*
A 3-level approach to nutrition education designed for use in elementary schools and cross-referenced to the various disciplines (mathematics, science, etc.). The activities in Level 1 introduce 5-to-7-year-old children to some basic thinking about what they eat, when and how much they eat, why they eat, and where their food comes from. The activities in Level 2 extend this thinking by focusing the attention of 8-to-9-year-olds on the power of food, food comparisons, food classification, food processing, and lifestyles and their consequences. The activities in Level 3 encourage 10-to-12-year-old pupils to base their decisions with regard to diet on the nutrients in food. Teachers using the program receive a 2-hour orientation workshop from the dairy council.

_____. *Loan projects and films.*
A leaflet catalog of 16-mm. films available from local/regional affiliates of the National Dairy Council. Includes such titles as *Eating on the Run* (15 min., JH, SH, A); *How a Hamburger Turns Into You* (20 min., In, JH, SH); and *The Big Dinner Table* (11 min., P, In).

_____. *Nutrition education materials.*
A catalog of instructional materials available (some without charge) from local/regional affiliates of the National Dairy Council. Includes card sets, charts and posters, films and filmstrips, models, publications, slides, and transparencies labeled for primary grade through adult-level users. Of particular value for an educational program in cardioenergetics, perhaps, are *A Boy and His Physique, A Girl and Her Figure,* and *The Great Vitamin Mystery.*

National Heart, Lung, and Blood Institute. *Report of the task force on blood pressure control in children.* Vol. 59, No. 5. May 1977. American Academy of Pediatrics, Evanston, Illinois.

The report includes a description of the methods and instrumentation used for measuring blood pressure in infants and children, some guidelines for identifying children with elevated blood pressure, suggestions for treatment, and possible mechanisms and causes for high blood pressure. Of particular interest are the recommendations of the task force with regard to blood pressure control in children and appendices 1 and 2, "Mean Systolic Blood Pressure (mmHg) in Children Aged 2 to 18" and "Mean Diastolic Blood Pressure (mmHg) in Children Aged 2 to 18."

Nutrition: Food vs. Health. #216-14, a 2-part filmstrip program. Sunburst Color Sound Filmstrips, 41 Washington Avenue, Pleasantville, NY 10570. 1975.

Examines the role of manufacturers, advertisers, and government agencies in shaping American eating habits.

Pal Health Books. #503 - 2-book set, plus teaching guides. #529 - *The body machine: parts and functions,* plus teaching guide. #507 - *The body machine: care and maintenance,* plus teaching guide. Xerox Education Publications, 1250 Fairwood Avenue, P.O. Box 444, Columbus, OH 43216.

A 2-book series designed to build good health habits through material presented in a short-story and comic-strip format created especially for pupils with reading handicaps.

The Physiology of Exercise. #232-14, a 2-part filmstrip program. Sunburst Color Sound Filmstrips, 41 Washington Avenue, Pleasantville, NY 10570. 1976.

A 2-part filmstrip program designed to emphasize the beneficial effects of exercise on the "total" human organism and to impart an understanding of the health hazard which lack of exercise can bring to people living in modern society. In particular, Part II shows how heart disease can be avoided by steady, rhythmic, moderate exercise; describes how stamina training (aerobics) increases strength and relieves tension; and compares vigorous popular exercises and sports in terms of their relative value to the body. Intended to encourage the development and implementation of effective exercise plans based on personal requirements and limitations.

President's Council on Physical Fitness and Sports. Room 3030, Donohoe Building, 400 6th Street, S.W., Washington, DC 20201. *Aquadynamics,* by C. Carson Conrad.

An instructional pamphlet on physical conditioning through water exercises. Available without charge in single to 5-copy lots through written request to the President's Council on Physical Fitness and Sports.

_____. *Newsletter.* Irregular.

Free to those on mailing list status, which is available upon request to the President's Council on Physical Fitness and Sports.

_____. *Physical fitness research digest.*

Free to those on mailing list status, which is available upon request to the President's Council on Physical Fitness and Sports.

Project Super Heart: A Heart Disease Intervention Program for Young Children. Institute for Experimentation in Teacher Education, State University of New York at Cortland, Cortland, NY 13045.

An elementary school program funded through ESEA, Title IV-C to encourage the development of lifestyles that will improve and/or maintain cardiovascular health. Includes cardiovascular fitness assessments, a combined curriculum of health education and prescribed aerobic activity, a maintenance program to be followed outside of school, and a physical fitness newsletter for young children.

Rhythmic Rope Jumping, by Annelis Hoyman. K 4000, LP record and manual for use with secondary school/college students. K 4001, LP record and manual for use with elementary school children. Educational Activities, Inc., P.O. Box 392, Freeport, NY 11520.

Rope-jumping routines in a variety of tempos drawn from workshop and course activities developed by Dr. Annelis Hoyman of the University of Illinois. The manual contains illustrated directions for the routines, and the records contain such musical accompaniments as *Do-Re-Mi, Shall We Dance, Chim Chim Cheree, No Two People, Sixteen Going on Seventeen,* and *Thumbelina.*

Run Dick, Run Jane. 20 min. color. 16 mm. Prod. by Brigham Young University, Department of Motion Picture Productions, Provo, UT 84602, in cooperation with the National Jogging Association. 1971. Available through local chapters of the American Heart Association.

A motivational film on the benefits of aerobic exercise, featuring Dr. Kenneth H. Cooper; Larry Lewis, a 103-year-old waiter who used to run 6 miles every morning before work; James Lovell, astronaut; and other persuasive proponents of regular exercise.

238

239

Run for Life. Connecticut Mutual Life Insurance Company, Hartford, CT 06115.
A "how to add fitness to your life" publication produced by the Connecticut Mutual Life Insurance Company.

The Seattle Project. National Center for Health Education, 211 Sutter Street, San Francisco, CA 94108.
An elementary school heart disease intervention program comparable to the Berkeley Project, but designed for use with children in kindergarten through grade 3. Since the program has been nationally validated, school personnel can apply for ESEA, Title IV-C funds to incorporate it into their ongoing K-3 programs.

Sinacore, J. S. *Health: a quality of life*; 2d ed. Riverside, NJ: Macmillan Publishing Company, Inc., 1974.

The School Health Curriculum Project. HEW Publication No. (CDC) 78-8359. U. S. Department of Health, Education, and Welfare; Public Health Service; Center for Disease Control; Bureau of Health Education; Atlanta, GA 30333. 1977.
A 52-page booklet describing the School Health Curriculum Project developed by Helen Delafield and Richard Foster, who were responsible for the Berkeley Project from which this program derived.

The Smoking Digest: Progress Report on a Nation Kicking the Habit. U. S. Department of Health, Education, and Welfare; Public Health Service; National Institutes of Health; National Cancer Institute; Bethesda, MD 20014. 1977.
Written for planners, leaders, and activists in smoking education/cessation programs at all levels, the Digest presents a summary of information about cigarette smokers (including teenagers) and current beliefs and attitudes about smoking; the biomedical effects of cigarette smoking; smoking information/education programs and campaigns; smoking cessation techniques and programs; smoking legislation and regulation; and the tobacco industry and its marketing efforts. Concluding that smoking is a complex social and behavioral phenomenon, the Digest outlines five interlocking strategies with recommendations for future efforts and identifies sources of additional information, materials, and other help for developing and implementing smoking education/cessation programs.

Smoking Scene. HE-1055, an 18" (45.7 cm.) x 24" (60.9 cm.) smoking display plus 100 smoking mini-texts and a 20-page lesson plan with 50 test questions. Spenco Medical Corporation, P.O. Box 8113, Waco, TX 76710.
Consists of 15 mock cigarette packages, each identifying and giving information about a disease associated with smoking, and a backdrop which mimics the techniques of cigarette advertisers.

The University of the State of New York. The State Education Department. Bureau of General Education Curriculum Development. *Design for heart disease prevention programs*. 1970.
Designed for coordinators of *adult* heart disease prevention programs, the publication contains fundamental information about (1) the problems of heart disease, (2) the identification of coronary risk factors, (3) the physiology of heart disease, (4) the relationship of nutrition, smoking, and stress to heart disease, and (5) a suggested physical conditioning program to prevent the disease. It also contains a course outline, instructional strategies, selected lists of multimedia resource materials, and a directory of related agencies — much of which is still current. A preliminary supplement which describes how to initiate community heart disease prevention programs accompanies the document.

_____. Bureau of School Health Education and Services. *Hypertension screening in schools: a program planning guide*. 1977.
A valuable aid to school health maintenance personnel for identifying children and youth with high or potentially high blood pressure and referring them to qualified medical personnel for proper care and followup. Includes three especially useful chapters: one on staff education, another on student education, and a third on program evaluation.

Walk, Jog, Run: Interval Training for Cardiovascular Fitness, by Les Smith and Gabe De Santis. KEA 1143, LP record and manual. KEAC 1143, cassette and manual. Educational Activities, Inc., P.O. Box 392, Freeport, NY 11520.
Developed and field-tested by the Educational Research Council of America in Cleveland, Ohio, the program consists of specifically timed rest and activity periods which "train without strain" for improved cardiovascular health. The record/cassette consists of four 6-minute segments of popular music designed for fitness activity performed at pulse rates of 160, 180, 200, and 220 beats per minute.

Wilmore, J. H. *Athletic training and physical fitness: physiological principles and practices of the conditioning process.* Boston, MA: Allyn and Bacon, Inc., 1979.

Young, D. R. *Physical performance, fitness and diet.* NASA Ames Research Center, Moffett Field, CA 94035. Springfield, IL: Charles C. Thomas, Publisher, 1977.

Considers the extreme nutritional states of obesity and chronic food deprivation, and the effects of supplementation and modification of normal diets on work capacity. Other topics include minimum feeding concepts, performance and body composition, insulin mechanisms, growth hormone, sports medicine, and sports management as it relates to athletic nutrition. Liberal use of figures and data tables provides objective information regarding nutritional states and their effects on treadmill exercises or comparable stress tests. Includes an extensive bibliography.

Young Men's Christian Association. *The official YMCA physical fitness handbook,* by Clayton R. Myers. New York: Popular Library, 1977.

_____. *The Y's way to physical fitness: a guide book for instructors.* Ed. by Clayton R. Myers, Lawrence A. Golding, and Wayne E. Sinning. 1979. Available through the National Board of YMCA's, 291 Broadway, New York, NY 10007.

212

213

Appendix

PULSE RATE RECORD CARD

Name _____ Age ____ Date _____

Fundamental Characteristics

Height_____ Occupation _____ Athlete Yes No

Weight_____ Body type _____ Coffee drinker Yes No

Relationship to student _____
(If this is the student's card, write *self*)

Resting Pulse Rates (*Record all counts in beats per minute*)

Reclining_____ Sitting_____ Standing_____ Early Morning_____

After breakfast_____ Mid-morning_____ After lunch_____

After drinking:

coffee_____, tea_____, cola_____, or an alcoholic beverage_____

After stressful events

Event 1. _____ Rate_____

Event 2. _____ Rate_____

Exercise Pulse Rates (*Record all counts in beats per minute*)

Pre-exercise pulse rate_____

Target heart rates: min._____ opt. (TS)_____ max._____

After stretching_____ *bpm* After ___ *no.* arm curls_____ *bpm*

After ___ *no.* situps_____ *bpm* After ___ *no.* min. of running in place_____ *bpm*

After ___ *no.* pushups_____ *bpm* After ___ *no.* min. of rope-skipping_____ *bpm*

After bench-stepping — *Bench height*_____ *in./cm.*

Rate	Stop	¼ min.	1 min.	1½ min.	2 min.	2½ min.	3 min.	3½ min.
20/min.								
30/min.								
40/min.								

After walking_____ _____ *min. per mile/kilometer*

After jogging_____ _____ *min. per mile/kilometer*

After running_____ _____ *min. per mile/kilometer*

Recovery time_____

STANDARD BLOOD PRESSURES for CHILDREN and YOUTH*

SYSTOLIC			DIASTOLIC	
Boys	Girls	AGE	Boys	Girls
99	99	3	57	58
98	98	4	57	60
101	102	5	60	60
105	105	6	60	64
106	107	7	63	63
108	108	8	61	65
111	112	9	65	67
114	114	10	66	64
114	121	11	65	69
116	117	12	67	65
120	121	13	65	69
120	119	14	68	67
125	115	15	67	67

*Derived from a study of 1593 children and youth (795 boys and 798 girls) between 3 and 15 years of age.

ENERGY EXPENDITURE and RELATIVE VALUE of ACTIVITIES for PROMOTING CARDIOVASCULAR FITNESS

Activity	*Energy Expenditure* (Calories per min.)	*Approximate Heart Rate* (Based on a resting hr of 70)	*Relative Value*
Very slow walking, studying, TV-viewing, reading	1 - 2	70 - 80	OF LITTLE VALUE - energy requirement is too low to stimulate the cardiovascular system.
Walking at 3 mph, bowling, golf (using power cart)	2.5 - 3.5	80 - 85	
Walking at 4 mph, light calisthenics, iceskating	4.0 - 5.0	85 - 90	ADEQUATE for many senior citizens or convalescents, but generally too mild for the young and healthy.
Cycling at 10 mph, tennis (doubles), badminton, swimming (breaststroke)	5.0 - 6.0	95 - 100	
Cycling at 12 mph, tennis (singles), waterskiing	6.0 - 7.0	105 - 120	Represents a lower limit of aerobic-type exercise, but must be *sustained* for 20 to 30 minutes.
Jogging at 5 mph, paddleball, swimming, (crawl) at 50 yd/min	7.0 - 8.0	125 - 140	BEST LEVEL of aerobic-type exercise, depending upon the participant's level of fitness at the beginning of the program. The pace must be low enough to allow continuous exercise for 15 to 20 minutes.
Running at 6 mph, squash (competitive), cycling at 13.5 mph	8.0 - 9.0	150 - 160	
Running at 7 mph (8.5 min. mile), handball (competitive), swimming (butterfly stroke) at 50 yd/min	10.0 - 12.0	160 - 175	
Running at 9 mph (7-min. mile), swimming ("all out"), mountain-climbing with pack, stair-running	>13	>180	PROBABLY TOO STRENUOUS for any except highly trained participants, but can be used in an interval mode.

WORK and ENERGY EXPENDITURE

POSITIVE WORK is determined by multiplying a force by the distance through which it moves (W = F x D). For example, if a 100-pound boy climbs a set of stairs 10 feet high, he accomplishes 100 x 10 or 1,000 *foot-pounds* of work.

POWER is the amount of work done per unit of time and is determined by dividing the amount of work accomplished by the time it took to do it. For example, if it took the boy one minute to climb the stairs, he would have used 1,000 ÷ 1 or 1,000 foot-pounds of power per minute. If he climbed them in half a minute, he would have increased his power output to 2,000 foot-pounds/minute. Thirty-three thousand foot-pounds per minute is equal to one *horsepower*. Thus the boy in the examples given above would have generated 1,000 ÷ 33,000 or .03 HP and 2,000 ÷ 33,000 or .06 HP, respectively.

The metric unit for work is the *KILOGRAM METER*, which equals 7.23 foot-pounds. In metric terms, the 100-pound boy who climbed a 10-foot set of stairs did 1,000 ÷ 7.23 or 138.3 kilogram meters of work.

NEGATIVE WORK is the amount of energy used in descent (walking down stairs, stepping down from a bench, etc.). It requires about one-third as much energy as positive work, and must be included in any calculation of energy where part of the task is going down. If the boy in the example went back down the stairs after he had climbed them, he did 1,000 x 1/3 or 333.33 foot-pounds of negative work.

CALORIES supply the energy for work. Since one calorie yields enough energy to do 3,086 foot-pounds of work, the boy in the example used 1,000 ÷ 3,086 or .324 calories going *up* the stairs and 333.3 ÷ 3,086 or .108 calories going *down* the stairs - a total of .432 calories or *less than half a calorie for the whole job.*

The *EFFICIENCY OF THE HUMAN MACHINE* is only about 25 to 28 percent. That is, for each calorie of useful work performed, nearly four times as many calories must be expended. The "extra" energy, like that in any other machine, is dissipated as heat — but this caloric expenditure must also be included in work computations.

BASIC METABOLIC RATE is the amount of energy needed to sustain vital functions. It, too, must be included in any work computations and can be found by multiplying the Basic Metabolic Rate for the individual's age and sex by that individual's body size. The product is expressed in calories per hour.

DESIRABLE WEIGHTS for TEEN-AGE BOYS and GIRLS

(Adapted from the Metropolitan Life Insurance Company's Tables for Adults)

BOYS

HEIGHT		AGE					AGE					AGE				
		13	14	15	16	17	13	14	15	16	17	13	14	15	16	17
Feet	Inches	Small Frame					Medium Frame					Large Frame				
4	8	87	89	91			96	98	100			108	110	112	114	116
	10	92	94	96	98		101	103	105	107		114	116	118	120	122
5	0	99	101	103	105		106	108	110	112	114	120	122	124	126	128
	2	105	107	109	111	113	112	114	116	118	120	127	129	131	133	135
	4	111	113	115	117	119	120	122	124	126	128	134	136	138	140	142
	6	118	120	122	124	126	128	130	132	134	136	142	144	146	148	150
	8	126	128	130	132	134	136	138	140	142	144	151	153	155	157	159
	10	135	137	139	141	143	144	146	148	150	152	161	163	165	167	169
6	0	145	147	147	149	151	153	155	157	159	161	172	174	176	178	180
	2		153	155	157	159		165	167	169	171		186	188	190	192
	4			162	164	166		176	178	180	182		196	198	200	202
	6			172	174	176		188	190	192	194		210	212	214	216
				±4%					±5%					±6%		

GIRLS

HEIGHT		AGE					AGE					AGE				
		13	14	15	16	17	13	14	15	16	17	13	14	15	16	17
Feet	Inches	Small Frame					Medium Frame					Large Frame				
4	4	77	78	80	81	83	83	84	86	87	89	93	94	96	97	99
	6	82	84	85	87	88	89	91	92	94	95	99	101	102	104	105
	8	87	88	90	91	93	94	95	97	98	100	104	105	107	108	110
	10	92	94	95	97	98	100	101	103	104	105	111	113	114	116	117
5	0	98	100	101	103	104	106	108	109	111	112	117	118	120	121	123
	2	104	105	107	108	110	113	114	116	117	119	123	125	126	128	129
	4	110	112	113	115	116	120	122	123	125	126	129	130	132	133	134
	6	117	119	120	121	123	127	128	130	131	133	137	139	140	142	143
	8	125	126	128	129	131	136	138	139	141	142	146	147	149	150	152
	10	134	136	137	139	140	144	145	147	148	150	156	157	158	159	161
6	0	144	145	146	148	149	153	155	156	158	159		165	167	168	170
	2	153	154	156	157	159		162	164	165	167		176	177	179	180
				±4%					±5%					±6%		

DAILY CALORIC NEEDS*

*Desirable Weight*** (in pounds)	*Sedentary Living*	*Light Exercise*	*Moderate Exercise*	*Hard Work*
104	1,560	1,768	1,976	2,288
108	1,620	1,836	2,052	2,376
112	1,680	1,904	2,128	2,464
116	1,740	1,972	2,204	2,552
120	1,800	2,040	2,280	2,640
124	1,860	2,108	2,356	2,728
128	1,920	2,176	2,432	2,816
132	1,980	2,244	2,508	2,904
136	2,040	2,312	2,584	2,992
140	2,100	2,380	2,660	3,080
144	2,160	2,448	2,736	3,168
148	2,220	2,516	2,812	3,256
152	2,280	2,584	2,888	3,344
156	2,340	2,652	2,904	3,432
160	2,400	2,720	3,040	3,520
164	2,400	2,788	3,116	3,008
168	2,520	2,856	3,102	3,696
172	2,580	2,924	3,268	3,784
176	2,640	2,992	3,344	3,872

*The caloric values on this chart are designed to *maintain*, not to achieve, desirable weights. They should be considered in terms of normal activity or lifestyle.

**If the desirable weight for you is not listed, refer to the nearest *lower* weight for the caloric values relative to your situation.

SIMPLE TESTS for OBESITY

THE MIRROR TEST

Remove all clothing and stand in front of a full-length mirror (after-bath or shower times are ideal). Look at your image and ask yourself (or a friend, the teacher, a member of the family, etc.), *Do I look fat?* If the answer is *yes*, you probably are obese.

THE RULER TEST

Lie flat on your back on the floor or on a similarly hard surface (a table, etc., *but not a bed*), and place a meterstick or a long strip of wood lengthwise down the center of your body. If the stick touches your chest and hips but not your waist, you pass the test. If it rocks back and forth on your abdomen, you are probably obese.

THE BELTLINE TEST

Exhale completely and measure the circumference or *girth* of your chest with an accurate measuring tape held just below the armpits and over the nipples. Then measure your waist at the beltline, with your abdomen relaxed *(not sucked in)*. Compare the two figures.

- For BOYS, the waist girth should be 5 inches smaller than the chest girth.
- For GIRLS, the waist girth should be 5 to 10 inches smaller than the chest girth, depending upon age and maturity.

252

HEIGHT/WEIGHT TABLES

Determine a desirable weight for you from a table like the one on page 122 which requires your age, sex, and body frame. If your present weight exceeds the value given in the table by more than 20 percent, you are probably obese.

QUICK SKINFOLD TEST

Locate the point on the back of your upper arm midway between the tip of your shoulder and your elbow (the triceps area). Take a pinch of skin from this point with the thumb and forefinger of the opposite hand. The pinch should include a double layer of skin and the subcutaneous fat, *but not the muscle*, beneath it. Measure the pinch (*skinfold*) with calipers (borrow a pair from the science department if the health and/or physical education department doesn't have any), or do a good estimate by comparing the thickness of the fold with the thickness of a book or magazine and then measuring the latter. Convert to metric, if necessary, and check the figure against the appropriate entry in the following table. If your skinfold measure is larger than the value given in the table, you are probably obese.

MINIMUM TRICEPS SKINFOLD for OBESITY

(Adapted from Mayer)

AGE	BOYS	GIRLS
12	18 cm.	22 cm.
13	18 cm.	23 cm.
14	17 cm.	23 cm.
15	16 cm.	24 cm.
16	15 cm.	25 cm.
17	14 cm.	26 cm.
18	15 cm.	27 cm.
19	15 cm.	27 cm.

SOMATOTYPE/PERSONALITY TYPE ASSESSMENT SHEET

NAME _____

Circle, ✓ check, underline, or otherwise indicate the items in each column below that seem to apply to you or your friend. Then add the number of items identified in each column and write it in the space marked TOTAL at the base of that column.

I am/You are:

dependent	dominant	independent
calm	cheerful	tense
relaxed	confident	anxious
complacent	energetic	reticent
contented	impetuous	self-conscious
sluggish	efficient	meticulous
placid	enthusiastic	reflective
leisurely	competitive	precise
cooperative	determined	thoughtful
affable	outgoing	considerate
tolerant	argumentative	shy
affected	talkative	awkward
warm	active	cool
forgiving	domineering	suspicious
sympathetic	courageous	introspective
soft-hearted	enterprising	serious
generous	adventurous	cautious
affectionate	reckless	tactful
kind	assertive	sensitive
sociable	optimistic	withdrawn
soft-tempered	hot-tempered	gentle-tempered

TOTAL _____

THE UNIVERSITY OF THE STATE OF NEW YORK

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1988	Willard A. Genrich, LL.B., L.H.D., LL.D., Litt.D. *Vice Chancellor*	Buffalo
1986	Kenneth B. Clark, A.B., M.S., Ph.D., LL.D., L.H.D., D.Sc.	Hastings on Hudson
1983	Harold E. Newcomb, B.A.	Owego
1982	Emlyn I. Griffith, A.B., J.D.	Rome
1983	Mary Alice Kendall, B.S.	Rochester
1984	Jorge L. Batista, B.A., J.D., LL.D.	Bronx
1982	Louis E. Yavner, LL.B.	New York
1986	Laura Bradley Chodos, B.A., M.A.	Vischer Ferry
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1981	Joseph R. Bongiorno, B.S., M.D.	Brooklyn
1984	Louise P. Matteoni, B.A., M.A., Ph.D.	Bayside
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1985	Arlene B. Reed-Delaney, B.A., M.D.	Albany
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